THE PEDAGOGICAL SEMINARY AND

JOURNAL OF GENETIC PSYCHOLOGY

Child Behavior, Animal Behavior, and Comparative Psychology

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The Journal of Genetic Psychology, 1948, **72**, 3-9

CHILDREN'S ATTITUDES TOWARD HOMOGENEOUS GROUPINGS*

Department of Psychology, Yeshiva University

ABRAHAM S LUCHINS AND EDITH H LUCHINS

A INTRODUCTION

The writers had occasion to conduct a series of experiments in several New York City public elementary schools in which the practice was to separate the pupils in each grade level into "homogeneous groups," on the basis of *IQ*'s and previous scholastic achievement There appeared to be a marked difference in social atmosphere between the 1- or bright-classes and the 2- or dull-classes The latter usually evinced a lack of interest, a lack of spontaneity, a kind of deadness, the bright classes were generally livelier, appeared happier, and displayed more interest. Teachers of the 2-classes complained that they had to rule with an iron hand, while the 1-classes, on the whole, were subject to less rigid discipline.

Since the social atmosphere might have influenced the results of the experiments, a detailed study was made of the attitudes of the pupils in one of the schools The experiments and the manner in which the results were affected have already been reported upon (1). This paper, long delayed by the senior author's entrance into the army, reports on the pupils' attitudes toward homogeneous groupings.

B. PROCEDURE

Every other child in the fourth, fifth, and sixth years of the elementary school was interviewed The subjects, 190 in number, were called out of the classroom, one at a time, and brought to the teachers' lounge where the experimenter attempted to put them at ease Discussion revealed that every pupil was aware of the significance of the superscript, 1 (bright), 2 (dull), or 3 (average), attached to his class The subject was told that the Board of Education was conducting a study to find out what kind of classes children prefer He was assured that whatever he said would be kept in confidence and, in turn, was asked not to discuss the questions or his answers with other children Five questions were asked, *one at a time*, the pupil receiving as much time to answer each as he desired After each

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answer, he was asked to give reasons or explanations for his choice In those instances where the wording of a question had to be modified in order that its intent be understood, care was taken not to alter its meaning While the child spoke, brief stenographic notes were taken by the experimenter, and immediately after he left the lounge, the remarks were written up in greater detail.

The five questions were the following

1. Imagine that you have been transferred to another school. When you arrive at the new school, you are asked, "Would you rather be in $6B^1$ or $6B^2$? In $6B^1$ are the brighter children of the 6B and in $6B^2$ are those who are not so good in their school work Which class would you choose?" (The reference to grade in this and the subsequent questions was changed to fit each child, e g, one in the 4A was asked to choose between $4A^1$ and $4A^2$)
2. Would your parents prefer that you be in $6B^1$ or $6B^2$?
3. After you were put into the class that you selected, suppose you found out that the teacher of the other class was better and kinder than yours Would you try to change classes if given the chance?
4. Would you frequently admit into your games and make friends with children in the other class?
5. From which class, $6B^1$ or $6B^2$, would you select your best friend?

C. RESULTS

Tables 1-5 summarize the responses made by the children to Questions 1-5, respectively The terms, bright, average, and dull, indicate whether they were in the 1-, 3-, or 2-class of the grade, while the terms, 1- and 2-class, are used to indicate their choices to the questions.

Table 1 shows that most pupils, regardless of their present status, would select the 1-class. The choice is almost unanimous in the bright-group, and decreases as we go to the average- and then to the dull-groups, but even in the latter three-fourths of the children prefer 1-class status The reader

TABLE 1

WOULD YOU CHOOSE THE 1- OR 2-CLASS?

Present class	Number of subjects	Per cent would choose 1-class	Per cent would choose 2-class
Bright	68	96	4
Average	70	87	13
Dull	52	75	25

will recall that the subjects were asked to give reasons for their selections Those in the bright-classes selected the 1-class because they "naturally belonged there," they would learn more, they did not want to waste time, it was an honor to be in it, the 2-class would be boring, they did not want to mingle or be educated with "dumbells" Children in the average- and dull-groups chose the 1-class because there was a stigma attached to the 2-class, "it has a reputation you can't get rid of," their parents would be proud of them, the teacher would not be so strict, they would have more fun, they would learn more, and besides, it paid to take the chance—they could always go back to the 2-class The few students in the bright- and average-groups who selected the 2-class did so because they thought they would get better grades, they would be outstanding, and they would be able to "take it easy" Those in the dull-classes who selected the 2-class said that it was best for them, that they would feel out of place or would not succeed in remaining in the 1-class, and—as some put it—"I won't be allowed into the 1-class anyway, so why should I pick it"

Whether or not the answers to Question 2 actually reflect their parents' wishes is not known, but in any event, they are of interest in so far as they reflect the pupils' views of their parents' desires Most children stated that their parents would prefer that they be in the 1-class (see Table 2). Their elders would be proud of them, they would be ashamed to have them in the 2-class, "they think I'm smart," "they want me to get ahead" A few pupils in the bright- and average-groups claimed that their parents would want them in the 2-class, because they would receive better grades and have less homework. One-fifth of the dull-class pupils said that their parents would prefer the 2-class, because it was best for them and they would have a better chance to be promoted.

TABLE 2
WOULD YOUR PARENTS PREFER THAT YOU BE IN THE 1- OR 2-CLASS?

Present class	Number of subjects	Per cent said parents prefer 1-class	Per cent said parents prefer 2 class
Bright	68	97	3
Average	70	92	8
Dull	52	80	20

The responses to question 3 (see Table 3) show that a large percentage of the average- and dull-class pupils would transfer to the other class if it had a "better and kinder" teacher, whereas 94 per cent of those bright-class children who had selected the 1-class would remain in it in-

TABLE 3
WOULD YOU CHANGE TO THE OTHER CLASS IF ITS TEACHER WERE BETTER AND KINDER

Present class	Had chosen 1-class Number of subjects	Per cent would not change because of teacher	Had chosen 2-class Number of subjects	Per cent would not change because of teacher
Bright	65	94	3	33
Average	61	18	9	22
Dull	39	23	13	38

spite of the teacher The latter argued that no teacher is all good or all bad, the "tougher" the teacher, the more one learns, and reiterated the advantages of the 1-class The former felt that an unkind teacher would demote them, that a kind teacher would help them and make them feel more secure, that they would not be able to learn unless they had a good teacher. Those children in the dull- and average-classes who would remain in the 1-class believed that the honor attached to this class outweighed the teacher-factor. The few pupils in the bright-class who would change to the 2-class, would do so because the lessons would be more interesting if the teacher were better, or because they did not like "nags" for teachers In answer to Question I, three pupils of the bright-class had chosen the 2-class, all three elected to remain there because they would be "so smart," they would not have to worry about the teacher Of the children in the average- and dull-groups who had originally selected the 2-class, some wished to remain in it, in spite of the teacher, since they knew that they would not succeed in the 1-class

Table 4 indicates that 91 per cent of the bright-group children who had selected the 1-class in answer to Question I, would not frequently play with pupils of the 2-class. Their refusal was based on these arguments: they wanted to play only with their equals, dull children were boring, lacking in sportsmanship, or got one into trouble, people would think they were dumb if they played with "dumbells." The small percentage of pupils in

TABLE 4
WOULD YOU FREQUENTLY PLAY WITH CHILDREN FROM THE OTHER CLASS?

Present class	Had chosen 1-class Number of subjects	Per cent would not often play with 2-class pupils	Had chosen 2-class Number of subjects	Per cent would not often play with 1-class pupils
Bright	65	91	3	0
Average	61	21	9	11
Dull	39	5	13	7

the average- and dull-classes who refused to play with 2-class children gave as their motives the last reason, and the statement, "If you play with smart people, you become smart." The few in the average- and dull-groups who had chosen the 2-class and who would not admit into their games 1-class pupils, said that bright children are "stuck-up," conceited, and don't play much anyway. The majority of the average- and dull-class pupils, and a few in the bright-classes, would choose playmates from the other class since they did not want to hurt anyone's feelings, "playing is playing," "they are just as human as I am," and (from a pupil in a bright-class) "just playing with them can't make me bad in my school-work."

Most of the children in the bright-classes insisted that their best friend come from the 1-class, while the majority of the average- and dull-class pupils regarded the class as an irrelevant factor (see Table 5) The former said that they liked to be with intelligent people, that they would have more in common with an intelligent best friend, they would be able better to understand and help one another, and they would not be ashamed to bring the friend home Those pupils in the average- and dull-classes who were not impartial would select their best friend from the 1-class since he would be able to teach them, or from the 2-class because bright children are conceited and don't make good friends, or because most of their present friends were in such a class

TABLE 5
FROM WHICH CLASS WOULD YOU CHOOSE YOUR BEST FRIEND?

	Had chosen 1-class				Had chosen 2-class			
		Per cent would choose best friend from				Per cent would choose best friend from		
Present class	Number of subjects	1-class	2-class	Either class	Number of subjects	1-class	2-class	Either class
Bright	65	80	0	20	3	0	0	100
Average	61	16	15	69	9	11	11	78
Dull	39	10	0	90	13	8	38	54

D Summary and Discussion

Interviews with 190 children of the fourth, fifth, and sixth years of a New York City public elementary school revealed that a high percentage of the pupils in the bright-, average-, and dull-classes preferred and believed that their parents would prefer that they be in the 1-class of their grade rather than the 2-class Whereas most of those who were in the bright-classes would not give up their 1-class status even if the teacher of the 2-class were "better and kinder," the majority of those in the dull- and average-classes would change their class because of the teacher-factor. A high percentage of the children in the bright-groups would not frequently play with and would not choose their best friend from the pupils of the 2-class, while most of those in the average- and dull-groups would choose playmates from the other class, and would select a best friend without regard to the superscript after his class.

Proponents of homogeneous grouping schemes which bring together pupils of similar ability claim that the duller child tends not to suffer as much from feelings of inferiority and frustration, and the brighter child tends not to be so complacent about his abilities, as might be the case in a mixed group. In this study it was shown that many of the dull-class pupils appeared to feel inferior and ostracized, there was a decided stigma attached to the 2-class label and strong social pressure to be in the 1-class The brighter children, in turn, were on the whole snobbish in their attitudes toward those in the 2-class. In brief, homogeneous grouping seemed to help create a kind of caste-system in the school.

Some schools separate the pupils on the basis of individual subject matters Thus, there are different groupings in the grade for arithmetic, others for reading, etc In the opinion of the writers, who saw this plan in operation in several public schools, it frequently resulted in placing the same children more or less consistently in the above-average or below-average classes, thus again resulting in two groups who were considered the brightest and the dullest in the grade. In these schools, too, evidence was found of an intellectual caste-system.

We do not wish to imply that it was the homogeneous grouping *per se* which created this state of affairs in the school Highly influential were the attitudes displayed towards the grouping by parents, teachers, and pupils, attitudes which may have stemmed from the basic competitive philosophy which seemed to pervade the school. The children displayed in large measure a "superficial" view of learning (2, p. 146), learning for the sake of high test marks, promotion, being in a bright-class, and other external rewards Honors and grades seemed to be the objectives regarded as primary by many students, parents, and even teachers. What may be required is a program aimed at combatting this competition and grade-grabbing, aimed at giving all concerned a more wholesome view of education and a better understanding of the rôle the school should play in developing the total personality of the child The attempt should be made to have each child function at his optimum level, and to work with and play with his schoolmates in a manner befitting members of a democratic society For the realization of this latter aim, it may be advisable to use so-called heterogeneous classes, provided they are sufficiently small to enable the teacher to handle children of various abilities, and provided provision is made for adequate remedial instruction and individual guidance

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GROWTH OF INTELLIGENCE DURING ADOLESCENCE*[1]

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As a by-product of a study of the prediction of intelligence at college entrance from earlier intelligence tests, data on pairs of testings with the American Council on Education Psychological Examination became available for a substantial population of adolescents These data were obtained from the files of the Educational Records Bureau. Records from two or more administrations of the American Council Examination were obtained for approximately 1,000 individuals ranging in age from 13½ to 20 These resulted from the annual testing carried on by the Educational Records Bureau in each of a number of its supporting schools The pairs of administrations of two forms of essentially the same test appeared to provide an advantageous opportunity for studying growth of intelligence during the teens

The American Council on Education Psychological Examination, which was developed primarily for use at college entrance, has been published in annual forms since 1924 Although the test has shown progressive development during that period, its general character has remained rather uniform from one year to the next Data have been made available each year for an extensive norming population of entering college students Although this population probably fluctuated somewhat due to shifts in the colleges reporting results and changes in the composition of student groups at particular colleges, the annual college norms were thought to provide reasonably stable norming groups in terms of which to express scores on a uniform basis

Records in the present study covered forms of the American Council Examination from 1931 through 1940 Ordinarily the form which was released in a particular year for college use was used by the Educational Records Bureau in their subscribing schools the same year

Data for the present study consisted of sets of two or more American Council scores for 1,004 pupils. In many cases three or more testings were available for a single individual, so it was possible to assemble data on 2,310

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[1] This investigation was supported by a grant from the Carnegie Corporation Test records were supplied by the Educational Records Bureau

pairs of tests given with a lapse of one year (within a week or two) between the two tests of a pair As originally available, these tests were reported as raw scores and as grade percentile scores for the Educational Records Bureau group. In order to convert them to a single scale with more nearly uniform and equally spaced units, these scores were converted into standard scores based upon the norming population of entering college students The published distribution of scores for each year's form of the test was used, and on the basis of this the raw scores were converted into normalized standard scores with a mean of 500 and a standard deviation of 100 The definition of units in terms of the assumption of uniformity from year to year and normality for the college entrance population must be borne in mind in the interpretation of all that follows

The next step was to study the gains in standard score from one testing to the next testing a year later. However, experience with the data suggested very strongly that the standard scores from one year to the next were not strictly comparable Evidence of this was found in the fact that gains involving certain pairs of forms were very much larger than gains involving other pairs In the extreme case, for example, it was found that the 447 individuals taking the 1938 form of the test and then taking the 1939 form one year later showed an average loss of 9 standard score points In comparison with this, from the 1939 to the 1940 forms the average change for 170 cases was a gain of 68 standard score points It seems quite clear that the norms for the 1939 form were unduly severe. Because of this lack of comparability of norms from year to year, records for each pair of years were kept separate in tallying the results

The original analysis involved tallying pairs of scores for testings one year apart by year of testing, by age group, and by whether the earlier test of the pair was the initial test recorded for that individual or a later one in a series of three or four tests The reason for separate tallies by year of testing has just been discussed Age at time of earlier test was the basic variable being studied, the problem being to relate amount of gain to age at time of original testing Separate tallying of cases where the earlier test of the pair was the initial record of testing with the American Council Examination and cases where the initial test was second or third in a sequence of three or four was carried out because of a desire to explore the possibility that the amount of gain might be a function of number of previous testings This was an effort to cast some light on the rôle of practice as opposed to growth in producing the gains in subsequent tests

When the data had been tallied as indicated above, the average gain was determined for all individuals taking tests in a particular pair of years. This was done separately for initial tests and for subsequent tests. Having available the average gain for all age groups for a particular pair of annual forms of the test, it was then possible to express the gain in a particular age group for that pair of forms as a deviation from the average gain for all ages. These deviation scores were then combined for the different years of testing into a weighted average deviation, weighting the deviation for a given age and pair of forms by the number of cases available for that particular combination of age and tests. The weighted deviation scores are shown in the third column of Table 1. At this point the deviations from

TABLE 1
RETEST GAIN IN INTELLIGENCE TEST SCORE FOR DIFFERENT AGE GROUPS

Age at initial testing	Number of observations	Deviation from average gain	Gain in standard score	Smoothed values for gain	
				Linear	Quadratic
13-6 to 13-11	15	5.1	39.6	45.2	39.3
14-0 to 14- 5	23	1.3	35.8	43.3	39.5
14-6 to 14-11	126	9.8	44.3	41.4	39.3
15-0 to 15- 5	201	4.9	39.4	39.6	38.7
15-6 to 15-11	354	0.3	34.8	37.7	37.8
16-0 to 16- 5	354	4.0	38.5	35.8	36.5
16-6 to 16-11	424	1.1	35.6	33.9	34.8
17-0 to 17-5	344	— 3.8	30.7	32.0	32.8
17-6 to 17-11	241	— 2.4	32.1	30.2	30.3
18-0 to 18- 5	132	—12.6	21.9	28.3	27.5
18-6 to 18-11	66	— 9.4	25.1	26.4	24.4
19-0 to 19- 5	22	5.7	40.2	24.5	20.9
19-6 to 19-11	8	—15.1	19.4	22.6	17.0

average for both initial pairs of tests and subsequent pairs of tests were combined. The column of deviation scores shown in Table 1 gives the change in rate of growth as one goes from initial age 13-6 to 13-11 to initial age 19-6 to 19-11. It can be seen from inspection that there is some decrement in rate of growth during this period.

In order to translate the deviation scores back to annual amounts of growth, an estimate was needed of the average amount of growth from one testing to another for all cases. This estimate becomes confused by the fact that norms for the successive annual forms of the test appeared not to be entirely comparable. The amount of gain from test to retest varied quite sharply from one year to the next. As an estimate of the true standard score gain, the gains for the eight different annual forms of initial test were averaged. Each year was given equal weight although the number of cases varied quite a bit from one year to the next. This gave a value of 40.2 standard score points as the increment in score from one testing to a test administered one year later

Some part of the gain from one testing to another a year later may be expected to be due to effects of practice on the first testing and the resulting familiarity with the type of materials included in the test. No clear separation of growth from practice can be made from the available data, but some clue as to the size of the two effects may be obtained by comparing gains from pairs of tests in which the earlier test of the pair is the first recorded testing of that pupil with the American Council test with gains for pairs in which the earlier test is the second or third of a set of three or four Making this comparison within groups of the same age and tested on the same forms of the test, and combining the results in a weighted average, it is estimated that the gain is 13 1 points greater when the earlier test is an initial testing than when it is the second or third of a longer sequence of tests Since the average gain of 40 2 reported in the last paragraph is made up of 1,004 initial test pairs and 1,306 subsequent test pairs, we can estimate that the gain for an initial test pair is 47.6 standard score points and for a subsequent pair 34.5 points

Taking the figure 34.5 as representing average gain at all age groups, relatively freed from specific practice effects with the test materials, the actual amount of gain at each age level may be obtained by adding that value to the entries in the third column of Table 1. The resulting values are shown in the fourth column of the table, and represent estimates of the actual annual increments in the abilities measured by the test It can be seen by inspection that individuals still showed appreciable gains at the highest ages included in this study

Since the specific entries in Table 1 show some irregularity, it seemed worth while to fit a smooth curve to these data by method of least squares in order to get more stable and representative values. Both linear and quadratic equations have been fitted to the data The line of best fit is

$$Y = 45.2 - 3\,76\,X$$

where

Y = growth in standard score points.
X = age in years in excess of 13 years, 9 months

The quadratic curve of best fit is

$$Y = 39.3 + 0\,72\,X - 0.74\,X^2$$

where X and Y have the same meaning as above The estimates resulting from these least square solutions are shown in the last two columns of Table 1.

Although it becomes extremely risky to extrapolate the above functions beyond the range of observed score values, it is an interesting intellectual entertainment to approximate the age at which growth ceases according to these curves. According to the linear solution the point of zero growth would be reached at age 25 years, 9 months. According to the quadratic solution the point of zero growth would be reached at age 21 years, 6 months. These values must, of course, be recognized as highly speculative

In general, the evidence from the present study is in line with the findings of Freeman and Flory (1) and other earlier investigators in indicating that, in the case of individuals still attending school, ability to achieve on a standard type of paper and pencil test of intelligence or scholastic aptitude continues to increase at least until age 20 and probably beyond It should be emphasized that the individuals in this group were both a rather select group intellectually and still actively engaged in the pursuit of formal education. Whether the same results would be found for a less able group or for one no longer undergoing schooling remains, of course, a question

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AN EVALUATION OF THE ADULT INTELLECTUAL STATUS OF TERMAN'S GIFTED CHILDREN*[1]

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In 1940 Terman retested about 950 of the group of individuals who had comprised the population for his *Genetic Studies of Genius* (3, 4) The retests were based upon a test made up of difficult synonym-antonym and analogies items which was called the Concept Mastery Test. Originally tested as children in the early 1920's, the members of this group at that time had Stanford Binet *IQ*'s of 135 or over The average *IQ* for the group was then about 150 At the time of the retest, some 20 years later, the individuals had reached adulthood and were in their late twenties or early thirties The purpose of this report is to compare the adult performance of this highly select group with that of the general adult public, in order to see to what extent they maintained the superiority exhibited in their childhood

This study uses, as a basis for interpreting the adult performance of the Terman gifted group, norms for the general adult public reported by R L Thorndike and Gallup (6). Thorndike and Gallup present data showing the performance of a cross-section of the adult voting population upon a steeply-graded power test of vocabulary The sample tested was the standard voting sample used by the American Institute of Public Opinion and will be referred to as the Gallup sample. Using the norms established upon this population as a scale of reference, the present study tries to relate to this scale the results for Terman's group on his Concept Mastery Test. The procedure was to administer both the tests to the same group, and determine general population percentile scores for the Concept Mastery Test

The tests involved in the conversion were (*a*) the Vocabulary Test used by Thorndike and Gallup and (*b*) the Concept Mastery Test used by Terman Though differing somewhat in length and in content, the two tests seemed to be enough alike to make the procedure of setting up score equivalents on the two tests quite defensible Both tests were verbal tests, and both

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[1] Dr L M Terman supplied both data on the Concept Mastery scores of the gifted group and copies of the Concept Mastery Test for use in establishing score equivalents. The materials on which the report is based are, therefore, in large measure his

were untimed power tests Furthermore, the Concept Mastery Test was in large part a vocabulary test of the same-opposite form, though it also included an analogies section. All told, it seemed as though the two tests should tap a very similar group of functions. In the testing of the general voting population two separate forms of the vocabulary test had been used, each for a half of the sample In the present study, both of these forms were given to each subject in the conversion group, and the final conversion has been based upon an averaging of values given by the two tests.

The first step in the work of establishing conversion values was to give both the Vocabulary and the Concept Mastery tests to an appropriate conversion group. The group was selected to cover about the same range of Concept Mastery scores as was found for the Terman population. The actual conversion group was composed of two rather distinct sub-groups, and in the following analysis the data from each of these sub-groups are handled separately One group of 198 consisted largely of college students from Teachers College, Barnard College, and Hunter College. The other group of 53 was made up of matriculated doctoral candidates at Teachers College and a few members of the Columbia University faculty The tests were given to most of the members of the first group in class as part of the class activities of courses in psychology Members of the second group took the test individually Both tests were given without specific time limits, though the exigencies of class schedules may have stopped some individuals before they would have stopped of their own accord. The limitation of time would have affected the Concept Mastery Test, if either, but the time allowed for this test was always at least the half hour suggested by Terman as adequate. Examination of test blanks suggests that there were few cases in which time restrictions were a factor in determining test scores Subjects taking the tests individually were permitted unlimited time

After the tests had been scored, the reliability of each test was determined for each of the conversion groups In the case of the vocabulary test, the correlation between the two forms was taken as the measure of reliability, while for the Concept Mastery test a split-half reliability was computed. The reliability of the Vocabulary test for the Gallup group was also estimated, using reliabilities obtained for various groups which had taken both forms of the test, and correcting for the greater variability of the cross-section adult group

Next, all the distributions of obtained scores on the vocabulary tests were translated into distributions of estimated true scores. This amounted to regressing each score toward the mean of its own group according to the formula

$$X_{true} = X\sqrt{r_{11}}$$

In this formula, X is a deviation from the group mean and r_{11} is the reliability of the test for that group.

Dealing with the distribution of regressed scores for the Gallup group, the Vocabulary scores corresponding to certain percentiles in the group were determined. This was done for both Form *A* and Form *B* of the test. Procedures to this point are presented in Tables 1 and 2. The percentiles studied were the 50th, 75th, 85th, 90th, 95th, 98th, and 99th.

TABLE 1
DETERMINATION OF TRUE-SCORE PERCENTILES FOR GALLUP GROUP, VOCABULARY TEST *A*

Distribution of Gallup group scores			
Obtained score (mid-point)	*True score* (upper limit)	*Frequency, in per cent*	*Cum per cent* (to limit)
20	20.08	.6	100.0
19	19.13	1.5	99.4
18	18.17	1.8	97.9
17	17.22	2.9	96.1
16	16.26	5.1	93.2
15	15.30	6.5	88.1
14	14.35	7.8	81.6
13	13.39	8.1	73.8
12	12.43	9.7	65.7
11	11.48	8.7	56.0
10	10.52	9.4	47.3
9	9.56	7.8	37.9
8	8.61	7.3	30.1
7	7.65	6.2	22.8
6	6.69	4.8	16.6
5	5.74	3.7	11.8
4	4.78	2.1	8.1
3	3.83	1.3	6.0
2		.8	4.7
1		.5	3.9
No score		3.4	

Percentiles—Gallup Group
$P_{50} = 10.82$
$P_{75} = 13.54$
$P_{85} = 14.85$
$P_{90} = 15.66$
$P_{95} = 16.85$
$P_{98} = 18.23$
$P_{99} = 18.87$

Reliability = .915
Mean = 10.93
$S = 3.86$
$S_{true} = 3.68$

TABLE 2

DETERMINATION OF TRUE-SCORE PERCENTILES FOR GALLUP GROUP VOCABULARY TEST *B*

	Distribution of Gallup group scores		
Obtained score (mid-point)	*True score* (upper limit)	*Frequency, in per cent*	*Cum per cent* (to limit)
20	20.11	.5	100.0
19	19.15	1.4	99.5
18	18.19	3.0	98.1
17	17.23	5.5	95.1
16	16.28	7.2	89.6
15	15.32	8.2	82.4
14	14.36	8.5	74.2
13	13.41	8.2	65.7
12	12.45	7.5	57.5
11	11.49	7.9	50.0
10	10.54	7.6	42.1
9	9.58	5.6	34.5
8	8.62	7.1	28.9
7	7.67	6.3	21.8
6	6.71	4.7	15.5
5	5.75	3.1	10.8
4	4.80	3.0	7.7
3	3.84	1.1	4.7
2	2.89	1.2	3.6
1	1.93	.4	2.4
No score		2.0	2.0

Percentiles—Gallup Group

P_{50} = 11.49
P_{75} = 14.45
P_{85} = 15.66
P_{90} = 16.35
P_{95} = 17.21
P_{98} = 18.16
P_{99} = 18.80

Reliability = .915
Mean = 11.37
S = 4.13
S_{true} = 3.95

Turning now to the distributions of true scores on the Vocabulary test for the conversion groups, the percentiles in these groups corresponding to the scores computed above were determined. For example, the Form *B* Vocabulary true score corresponding to the 95th percentile of the Gallup group was found to be 17.21. Turning to the distribution of college students, we find that this corresponds to the 83.9th true score percentile of that group. Turning again to the doctoral candidates, we see that this score corresponds to the 8.3th true score percentile for this group. The data concerning this step are presented in Tables 3, 4, 5, and 6.

Next, we computed the true score distribution for both conversion groups on the Concept Mastery test. We can then find the Concept Mastery scores corresponding to the percentiles mentioned above. That is, the 83.9th percentile in the college group corresponds to a Concept Mastery score of 97.5, while the 8.3th percentile of the doctoral group corresponds to a score of 80.2. These scores, then represent two estimates of the score which would fall at the 95th percentile of the Gallup cross-section adult group. The Concept Mastery distributions and the scores corresponding to the different Gallup percentiles are presented in Tables 7 and 8. Since Forms *A* and *B* of the vocabulary test provide two separate estimates of the equivalent Concept Mastery score, these two are averaged to give a composite estimate.

TABLE 3
COLLEGE GROUP PERCENTILES CORRESPONDING TO GALLUP GROUP PERCENTILES
VOCABULARY TEST *A*

	Distribution of doctoral group scores		
Obtained score (mid-point)	*True score* (upper limit)	*f*	*Cum f* (to limit)
20	19.29	2	198
19	18.52	8	196
18	17.75	15	188
17	16.98	41	173
16	16.21	31	132
15	15.44	33	101
14	14.67	25	68
13	13.90	19	43
12	13.13	12	24
11	12.36	6	12
10	11.50	3	6
9	10.82	2	3
8	10.05	1	

Reliability = .594
Mean = 15.22
S = 2.25
S_{true} = 1.73

Gallup percentile corresponds to	*college percentile*
50	1.5
75	17.2
85	38.2
90	55.5
95	83.9
98	97.5

The college group yields estimates of the 50th, 75th, 85th, 90th, 95th, and 98th percentiles, while the doctoral group gives estimates of the 95th, 98th,

TABLE 4

DOCTORAL GROUP PERCENTILES CORRESPONDING TO GALLUP GROUP PERCENTILES
VOCABULARY TEST *A*

Obtained score (mid-point)	*Distribution of doctoral group scores* *True score* (upper limit)	*f*	*Cum f* (to limit)
20	19.50	8	53
19	18.94	25	45
18	18.39	5	20
17	17.83	7	15
16	17.28	3	8
15	16.72	5	5

Reliability = 306
Mean = 18.25
S = 1.39
S_{true} = 0.77

Gallup percentile corresponds to	*doctoral percentile*
95	10.75
98	35.05
99	61.90

TABLE 5

COLLEGE GROUP PERCENTILE CORRESPONDING TO GALLUP GROUP PERCENTILES
VOCABULARY TEST *B*

Obtained score (mid-point)	*Distribution of college group scores* *True score* (upper limit)	*f*	*Cum f* (to limit)
20			
19	18.57	8	198
18	17.80	18	190
17	17.03	40	172
16	16.26	41	132
15	15.49	37	91
14	14.72	26	54
13	13.95	8	28
12	13.18	9	20
11	12.41	7	11
10	11.64	2	4
9	10.87	1	2
8		1	1

Reliability = 594
Mean = 15.44
S = 2.06
S_{true} = 1.59

Gallup percentile corresponds to	*college percentile*
50	1.8
75	22.7
85	50.0
90	69.1
95	89.0
98	98.0

TABLE 6
DOCTORAL GROUP PERCENTILES CORRESPONDING TO GALLUP GROUP PERCENTILES VOCABULARY TEST *B*

Distribution of doctoral group scores			
Obtained score (mid-point)	*True score* (upper limit)	*f*	*Cum f* (to limit)
20	19 52	4	53
19	18 97	25	49
18	18 41	13	24
17	17 86	6	11
16	17 30	4	5
15	16 74	1	

Reliability = 306
Mean = 18 30
S = 1 13
S_{true} = 0 63

Gallup percentile corresponds to doctoral percentile	
95	8 3
98	34 0
99	78 3

TABLE 7
CONCEPT MASTERY SCORES CORRESPONDING TO GALLUP GROUP PERCENTILES ESTIMATED FROM COLLEGE GROUP

Distribution of concept mastery scores for college group			
Obtained score (mid-point)	*True score* (upper limit)	*f*	*Cum f* (to limit)
144 75		1	198
134 75	134 8	1	197
124 75	125 5	3	196
114 75	116 2	3	193
104 75	106 8	14	190
94 75	97 4	14	176
84 75	88 1	19	162
74 75	78 7	26	143
64 75	69 4	29	117
54 75	60 1	38	88
44 75	50 7	24	50
34 75	41 4	10	26
24 75	32 0	9	16
14 75	22 7	5	7
4 75	13.4	1	2
— 5 25		1	

Reliability = 874
Mean = 64 85
S = 25 9
S_{true} = 24 2

TABLE 7 (*continued*)

	Score corresponding to Gallup percentiles Estimated from		
	Vocabulary A	*Vocabulary B*	*Combined*
P_{50}	15.3	16.3	15.8
P_{75}	44.5	48.9	46.7
P_{85}	57.0	63.6	60.3
P_{90}	67.2	76.5	71.8
P_{95}	90.8	97.5	94.2
P_{98}	116.2	119.3	117.8
P_{99}	134.8	?	

TABLE 8

CONCEPT MASTERY SCORES CORRESPONDING TO GALLUP GROUP PERCENTILES ESTIMATED FROM DOCTORAL GROUP

Distribution of concept mastery scores for doctoral group			
Obtained score (mid-point)	*True score* (upper limit)	*f*	*Cum f* (to limit)
164.75	168.2	7	53
154.75	158.6	7	46
144.75	148.9	6	39
134.75	139.3	8	33
124.75	129.6	5	25
114.75	119.8	2	20
104.75	110.3	5	18
94.75	100.6	4	13
84.75	91.0	4	9
74.75	81.3	5	5

Reliability = .934
Mean = 125.5
S = 29.2
S_{true} = 28.2

	Score corresponding to Gallup percentiles		
Percentile	*Estimated from Vocabulary A*	*Estimated from Vocabulary B*	*Combined*
95	83.0	80.2	81.6
98	113.2	110.4	111.8
99	139.1	153.4	146.2

and 99th percentiles. Two separate estimates are therefore available for the 95th and 98th percentiles. Because of the larger numbers in the college group, it should carry greater weight in a final estimate of the 95th percentile. However, the 98th percentile falls so near the tail of the college distribution that it seems reasonable to weight the college and doctoral groups equally at this point. Giving the college group double the weight of the doctoral group in computing the 95th percentile and equal weight for the

98th, we get as final estimates of the Concept Mastery scores corresponding to various percentiles of the adult voting public the following (Table 9).

TABLE 9

General adult percentile	Concept mastery score
50	15.8
75	46.7
85	60.3
90	71.8
95	89.8
98	114.8
99	146.2

The distribution of Concept Mastery scores obtained for the Terman group (adults who in childhood received Stanford Binet *IQ*'s of 135 or over) is presented in Table 10. It will be seen from this table that the mean of the gifted for both men and women falls slightly above the 95th percentile score of the Gallup sample, with the men scoring slightly higher than the women. The scores for the Terman group range from higher than any received in the doctoral group down to about the average of the adult

TABLE 10
DISTRIBUTION OF CONCEPT MASTERY SCORES OF TERMAN GIFTED GROUP

Score	Men	Women	Total
170-179.5	2		2
160-169.5	6		6
150-159.5	13	5	18
140-149.5	24	11	35
130-139.5	50	29	79
120-129.5	45	42	87
110-119.5	58	48	106
100-109.5	65	54	119
90- 99.5	52	59	111
80- 89.5	59	51	110
70- 79.5	51	34	85
60- 69.5	31	36	67
50- 59.5	38	26	64
40- 49.5	13	19	32
30- 39.5	21	10	31
20- 29.5	2	5	7
10- 19.5	1	1	2
0- 9.5	0	0	0
N	531	430	961
Mean	97.63	93.54	95.80
SD	31.71	28.97	30.58

voting public However, relatively few cases fall above the 99th percentile score of the Gallup group and relatively few fall below the 75th percentile score Insofar as these data present a true picture, the test scores of these adults who were so outstanding as children now spread out over the top fourth of the adult voting public, with about half their number falling in the top five per cent and about half spreading over the next 20 per cent Since in childhood all fell within the top one percent of the child population, this represents a substantial regression of their adult test performance back toward the mean of the general population.

The actual amount of regression from childhood to adult score is difficult to estimate, because there is not complete agreement as to the variability of Stanford-Binet *IQ*'s. The standard deviation in Terman's original standardization group was about 12 points in *IQ* (5). However, two comprehensive surveys of Scottish children have yielded standard deviations of about 16 points (1, 2). The larger figure seems more generally in accord with the accumulated research findings Taking the larger estimate, the average of the Terman group in childhood would fall about three standard deviations from the population mean To translate the Concept Mastery scores into these same terms, we must translate the percentile values into standard deviation units. The mean score of 95 80 for the whole gifted group is estimated to correspond to a percentile in the adult population of 95 8 If, now, we assume a normal distribution of the ability tapped by the Concept Mastery test, this corresponds to a score 1 73 standard deviations above the mean. Comparing this with childhood status, it appears that the group have regressed some 40 or 45 per cent of the way back to the population mean.

The estimate of the amount of regression which we have just presented is somewhat greater than that arrived at by Terman and McNemar (3) using data from various other sources Their estimates are based largely upon the comparison of Concept Mastery scores with other scores obtained by groups of college students and estimates as to the degree of superiority of the college groups to the general adult population. Using material of this type, McNemar estimates that the average Concept Mastery score in the general adult population would be 2 (as compared with our estimate of 16), and that the gifted group now falls approximately two standard deviations above the population mean. It is probably true that the Gallup sample, which was restricted to the *voting* adult public, is somewhat superior to the *total* adult public Part of the discrepancy may be accounted for on those grounds. In part, it may reflect merely the moderate divergence to be expected in two estimates arrived at through different data The estimate resulting from the present study, that the gifted group are three-fifths as far from the adult mean on highly verbal adult tests as they were in Binet score as children, may perhaps be thought of as a maximum estimate of the regression in score over the 20-year period

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MANUAL DOMINANCE IN NURSERY SCHOOL CHILDREN*

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Although the development of handedness in young children is a matter of considerable importance to parents and nursery school workers, little research on the topic has been done in the early age levels. Since hand usage habits are largely formed during the nursery years, observations during this early growth period would have the most significance for all who are responsible for early childhood training.

Most surveys of the incidence of right- and left-handedness have been based on school populations over five years of age The results reveal little about developmental tendencies in hand dominance, for by school age manual habits for the most frequently repeated usages are well-established The few studies that have been made of nursery school children report observations of isolated individuals, lump together data from several age levels, or tend to report results of limited testing and observation Sometimes preconceptions as to the origin of handedness have tended to limit the observations and to bias the conclusions.

Until recent years, it is 'true, young children have scarcely been accessible in substantial numbers for research on this subject, but with nursery schools everywhere prevalent today it is possible to undertake more comprehensive and better controlled studies

A DEGREES OF HAND DOMINANCE

Anyone who observes young children even casually realizes that there are not two distinct categories, right- and left-handedness, but that manual dominance is a matter of degree This fact has been recognized in the studies of Durost (1), Heinlein (3), Koch (4), and many others. Every normal child is two-handed to some degree. In fact, most strongly right-handed people use the left more often for seldom practiced usages than they themselves realize.

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B "NATURAL" VERSUS "LEARNED" HANDEDNESS

Through all the years that handedness tendencies have been reported in scientific literature, the common assumption has been made that hand dominance is hereditary, a recessive trait, some people are born right-handed, some left-handed, and some are ambidextrous. Specialists in this field have admitted the difficulty of explaining "stubborn" or "fixed" left-handedness in any other way Most of the data on which the assumption of hereditary handedness has been made have been obtained from clinical cases and older subjects with long-established hand habits.

In child training, parents and teachers, following the dictate of the experts, have tended to wait for "natural" hand dominance to appear, and then to train accordingly, encouraging right- or left-handedness, whichever seemed to be the most natural for the child. It is assumed that unless the child's "natural" dominance is discovered early and encouraged, nervous conditions and speech disorders commonly attributed to confusion from "changing-over" may arise The belief is certainly widespread that handedness is a fixed and definite trait

Furthermore, many persons have the impression that training, for example in eating, imposes an artificial or unnatural dominance on "natural" left-handedness. The common viewpoint is that many naturally left-handed persons become right-handed for some activities through the training they receive

Within recent years, chiefly due to greater interest in the pre-school child, increasing evidence has suggested that handedness is a developmental trait, and that social conditioning involving many complex factors largely accounts for the emergence of hand dominance. What the child inherits is capacity to achieve dominant skill in either hand, but since a right-handed bias prevails everywhere in our civilization today, the majority of people become right-handed.

All young children in infancy and the early years show considerable tendency toward both right- and left-handedness. Between seven and nine months right-handedness begins to prevail but only to a slight degree Through the years right-handedness gains the ascendency, and left-handedness is gradually eliminated until by adulthood not more than three or four per cent of the population are left-handed for skills such as eating and writing.

Between birth and age four manual habits are still largely in the formative stage and dominance can scarcely be considered a fixed trait

The popular attitude toward handedness was summed up by one parent who said, "We don't believe in interfering with a three-year-old's natural handedness Since it is largely a physical matter, we always consult our physician in these matters." Some parents guard and defend the child's first indications of left-handedness with religious zeal, considering the tendency an "Act of God" or an inborn handicap "If you try to influence handedness you upset the child's brain," is a common belief Parents commented of one lively infant, "She shows signs of becoming a left-hander" The idea of training the child's handedness comparable to training children to overcome their fears, to like squash, or enunciate words more distinctly is seldom entertained. Yet there is mounting evidence that children drift into handedness largely "hit and miss," and that the chance direction once taken is confirmed as a habit with continued practice Of course, preference tends not to be shown until the child begins to gain more refined skill in the use of both his hands

To suggest that handedness may be the result of training and practice seems incredulous to those who tend to ascribe physical traits to heredity The question at once arises, If hand dominance is largely determined by social conditioning, how then can we account for strong left-handedness which society tends steadily to eliminate? Left-handedness is a much less definite trait than most people suppose it to be Furthermore, a "let-alone" or "protective" policy in the nursery years amounts to training Some parents on seeing the child use his spoon in the left hand jump to the conclusion that he is destined to become a "south paw" and deliberately cultivate the trait

C Studies of Manual Dominance in Young Children

The most systematic studies of manual dominance in infants and nursery age children have been made by Giesecke (2), Heinlein (3), and Updegraff (5) Six of the 17 infants studied by Giesecke showed left-handed tendencies All showed considerable instability in handedness Updegraff found more consistency in taught or much practiced hand usages than in those little practiced or untaught in the nursery years. Right-handed children were more strongly dominant than the left-handed They were more variable in bimanual than in unimanual skills Heinlein reported, as Koch and others have done, how much positional convenience or preoccupation with one hand determined which hand would be chosen for random acts Other findings were that right-handedness prevails in all age groups after the infant years, that young children show considerable instability in hand usage, and that nursery school children respond readily to parental or nursery school training

In several studies observation of eating habits was deliberately avoided because of the assumption that training in eating obscured native handedness, the only trait the observers were concerned with.

D. OBSERVATION OF HANDEDNESS IN NURSERY SCHOOL CHILDREN

In order to gain more comprehensive evidence on this subject, the writer undertook an extensive series of observations of handedness in nursery school children The subjects were all children enrolled in the Manhattanville Day Nursery, New York City.[1] To this nursery children between the ages of two and four are admitted for an all-day program Many of the parents are foreign born and in the lower income groups. The children are selected largely on the basis of family need There tend to be more boys than girls in the older age groups

Observations were limited to one-handed behavior since it is chiefly in connection with unimanual usages that problems arise, and because training at home and at school is largely confined to the skills that are predominantly one-handed. It was impossible to undertake a controlled training program, but the effects of incidental training and social conditioning were observed.

The questions toward which observations were directed were: When a child uses one hand alone for any activity, which hand does he use? and, What is the relative proportion of right and left choices, for various activities among these children in the different age groups?

Observations were made of 44 children, 25 boys and 19 girls, during October and November, 1946. The distribution of their ages is shown in Table 1. None of these children were mentally or physically handicapped in any way. However, they showed typical variability in mental and emotional responsiveness, and attendance of a number was irregular due to illness or exposure to childhood illnesses As a group they were normal in motor development and as a result of their nursery school experiences, well above the average in self-help. Some of them seemed less mature than average in language development, possibly because of foreign background in many cases

1. *The Tests and Observations*

Systematic observations were made of the hand employed in eating with spoon and fork, eating with the fingers, i e, taking a piece of bread or slice of apple, and drinking from a glass or cup. Extensive observations were

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[1] I wish to acknowledge the assistance of the staff of the Manhattanville Day Nursery, New York City, who cooperated in this study

TABLE 1
AGE DISTRIBUTION FOR THE 44 SUBJECTS

Age	
5-0	
4-9	2
4-6	2
4-3	8
4-0	7
3-9	5
3-6	3
3-3	4
3-0	5
2-9	2
2-6	2
2-3	2
2-0	2
Median = 3-10	
Total 44	

also made of the random "off-guard" behavior of these same children in the room and on the playground in such activities as throwing things, picking up and handling various tools and toys, taking hold of another child, pulling or pushing vehicles, shoveling and using utensils in the sand pile, bodily habits such as thumbsucking, or scratching one's self, hitting and slapping Repeated observations were made of each child for several days in succession until an adequate sampling of each child's behavior had been recorded Irregularities of attendance made it impossible to obtain exactly the same number of observations for every child at the time the observations were concluded No record was included in summarizing results that did not represent a comprehensive sampling of each child's handedness behavior over a period of five or six days.

Eating with the fingers was observed both during the mid-morning snack period when children were given bread or crackers as well as at lunch time when they had bread and sometimes a dessert such as cookies or apple slices that were eaten with the fingers, or when the children were observed taking food from their dishes with the fingers instead of with spoon or fork

The two-year-old group did not use forks, hence observations of eating with silverware were confined to the use of a spoon

In observing random acts, an attempt was made to get as full a sampling of each child's daily activities as possible, at different times of the morning and in varying situations For the two-year group the number of random observations for each child averaged 19, for the three-year-olds 14, and for the four-year-olds, 15.

In addition to the observations, each child was tested several times on different days in throwing a ball, shaking a rattle, spinning a top, drawing with crayons, using a toy shovel, and running a toy automobile. Ordinarily, the tests were given one right after the other. The test object was placed directly in front of the child and every effort was made in administering the tests to avoid influencing the child's handedness.

At the outset it was noticed that some children made much more use of one hand alone than others and that some confined themselves to a narrower repertory of acts. The younger children and those new to the school showed more tendency than others to use both hands together, for example, in drinking from a glass, eating bread, carrying a doll, catching a ball, or dumping sand.

In general, the boys were more active than the girls, throwing, pushing, pulling, and building more strenuously. The girls' activities too, were somewhat different from the boys' since they involved more doll play, housekeeping and tea party activities, and more table games.

2. *Results of the Tests and Observations*

Handedness ratios or indices were computed for each child's results as a whole and for the three separate age levels for each test or observation category, using the formula employed in previous studies by Koch (4) and Durost (1). Durost gives a nomograph for computing these indices. The formula is

$$\text{Index of dominance} = \frac{R-L}{R+L}$$

in which R and L stand for right and left hand, respectively. High positive

TABLE 2
RIGHT-LEFT HAND INDICES FOR THE THREE AGE GROUPS

Activity	Age 2	Age 3	Age 4
Using spoon	834	81	.676
Using fork	——	821	575
Drinking-glass or cup	.212	304	387
Eating with fingers	00	147	.015
Throwing ball	722	774	655
Spinning top	304	476	.50
Shaking rattle	375	60	612
Using crayons	.631	874	60
Using shovel	647	705	62
Running toy car	52	253	151
Other activities	0327	353	158

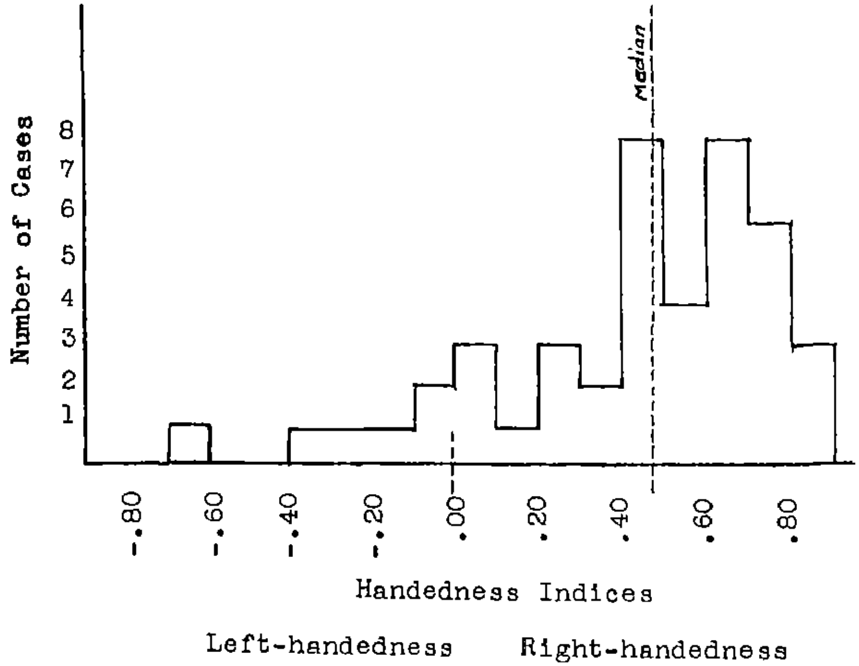

FIGURE 1
Distribution of Handedness Indices for 44 Nursery School Children

scores approaching 1.00 signify a high degree of right hand dominance, low negative scores approaching —1.00, on the contrary, indicate a high degree of left-handedness, and scores around .00 mean ambidexterity or lack of distinctive dominance.

Table 3 shows the distribution of handedness indices for each child's results as a whole. This distribution is shown graphically in Figure 1. The median index was .4875, with the distribution skewed to the right. Only six of the children or 11.1 per cent fell on the negative side of the curve indicating dominant left-handedness.

3. *Comparison of Indices for the Different Tests and Observations*

An examination of Table 2, which gives the indices for eating with fork and spoon, eating with the fingers, drinking from a glass or cup, the various test items and the random observations shows marked differences among these various items. The highest positive indices for all age groups

TABLE 3
DISTRIBUTION OF RIGHT-LEFT HAND INDICES FOR THE 44 SUBJECTS

		Age 2			Age 3			Age 4			
Index	Girls	Boys	Tot	Girls	Boys	Tot.	Girls	Boys	Tot	Tot	
.80					1	1		1	1	3	
75				1		1	1		1	2	
.70				2	1	3		1	1	4	
65			1	1	1	2		1	1	3	Right hand
60	1		1	1	2	3	1		1	5	Dominance
.55				1		1	1		1	2	
50						1	1	1	2	2	
45		1	1					3	3	4	
40	1	1	2		1	1		1	1	4	
35					1	1		1	1	1	
.30	1		1							1	
.25		1	1	1		1	1		1	3	
.20											
15					1	1				1	
10											
.05											
00		1	1	1		1	1		1	3	
—05	1		1				1		1	2	
—10											
—.15								1	1	1	
—20											Left hand
—25								1	1	1	Dominance
—30											
—35								1	1	1	
—40											
—45											
—50											
—.55											
—60											
—65											
—.70					1	1				1	
N =	4	4	8	8	9	17	7	12	19	44	
M =	.375	35	375	.65	625	.625	525	4667	475	4875	
R =			—042 to .603			—674 to .81			—32 to 834		

Median Index for the left dominant = —175
Median Index for the right dominant = 55

are found for eating with a spoon, .834, .81, 676 for the three age levels, and using a fork, .821 in the three-year level. The lowest indices for the three groups are found in eating with the fingers, .00, .147, 015 for the three different age groups. Throwing a ball ranks next highest after eating with silverware, .722, .774, and 655, followed closely by using crayons, .631, 874, and .60 In fact, in the three-year group using crayons shows a higher index of right-handedness than throwing a ball. Using a shovel also shows relatively high indices for all age groups, .647, .705, and 62, suggesting a possible association between this activity and using a spoon or fork

The indices for "other" activities representing the random observations in spontaneous acts are not far from the zero point or ambidextrous line in all the age groups (for age two, 0327, age four, 151) except for the three-year group where the index rises to .353.

The tested responses showed higher indices throughout than the observations of spontaneous, random manual usages even though they were often comparable, for example, throwing a ball in the tests and throwing a block or toy in play

From this analysis it is obvious that the acts most subject to training,—eating with silverware, throwing, and crayoning—show consistently more right-handedness and appear to have become more stereotyped from persistent usage than untrained or seldom practiced acts

Among the "other" activities observed, not all were strictly comparable so far as hand usage is concerned Taking and placing things is probably not in quite the same class as using some tool or utensil. No attempt was made to analyze the results for the separate random acts since relative degrees of dexterity demanded could only be conjectured, and it is uncertain how much hand preference depends upon motor dexterity.

It may be that during tests the mere presence of an examiner tended to elicit more right-handedness than would otherwise be the case. All the children, once they were persuaded to try, seemed eager to "put the best foot forward" and to make a good showing.

The hand chosen for eating with the fingers seemed at many times to be influenced by positional convenience or the fact that one hand, usually the right, was already occupied In about a third of the "finger-eating" observations, one hand was already occupied with a fork, glass, cup, or spoon. However, even when neither hand was already occupied, choices appeared to be about 50-50, right or left, in the younger age groups, slightly higher with the older children With some of the older children, holding a slice of bread in the left hand while the right was occupied with a fork seemed already to have become an established habit On many other occasions it was noticed that hand choice for spontaneous acts was influenced by positional convenience or preoccupation of one hand.

Drinking from cup or glass shows consistently higher indices in all age groups than "finger feeding," yet it is consistently nearer the zero or ambidextrous line (212, 304, .387), than to perfect right-handedness.

The differences among these various indices may not be statistically reliable because the number of cases is small. However the trends are unmistakable and appear at all age levels. Handedness in eating habits appears to vary with training factors which are strongest in using a fork and spoon, influential to a slight degree in drinking from a cup or glass, but scarcely a factor at all in "finger-feeding."

Here again, the question of dexterity enters. Is a greater degree of dexterity required in using a spoon or fork than in eating with the fingers or drinking from a cup? The question cannot be answered without additional data. The children often used both hands in drinking, seldom in using a fork or spoon, suggesting, perhaps, that drinking requires the greater dexterity.

There was considerable fluctuation observable in hand usage in the same child over several days, especially in the youngest group.

Often the more strongly right-handed children were observed to pick up a toy or implement with the left hand and after a little time, shift it unconsciously to the right where it remained. Most of this transposition appeared to be done by feeling rather than through visual control.

4. *Age Level Differences*

The trend toward right-handedness increased in the three-year group as compared with the two-year-group, .375 for the two-year-olds, and 625 for the three-year-olds, but it dropped again for the four-year-olds, 475. Left-handedness increased in the four-year group. Both ambidexterity for random acts and right-handedness in eating with a spoon are highest in the two-year group. This fact would seem inconsistent except that ambidexterity in this group reflects the lack of maturity in motor habits characteristic of the two-year-old, and the high index of right-handedness in eating suggests the ease with which two-year-olds respond to motor training whether it is direct or incidental. With such small numbers of cases in each age group it is not safe to conclude that the differences found are statistically reliable. Furthermore, these are not reports of the same children through a three-year age span, but of different groups at each age level.

The four-year group differed from the other two in two important respects: there were more boys, proportionately, in the group and fewer of the four-year-olds entered the nursery at so young an age as the two- and three-year-olds. Hence, any training factors were weightier for the first two groups

More of the four-year-olds on entrance brought with them hand usage habits already well-established at home, especially for eating

All the children with indices near the ambidextrious line may be considered as relatively immature or untrained in manual habits

5 *Sex Differences*

All reports in the literature note the greater incidence of ambidexterity and left-handedness in boys contrasted with girls Differences obtain at all age levels. The same phenomenon appears in these data Girls are more right-handed on the whole than boys The differences are small, but they are in the same consistent direction throughout the three age levels To some extent these differences are ascribable to social conditioning, because of the differences between boys and girls as noted above in play activities The girls did more "seat work," more looking at picture books, more "pretend" doll-feeding, ironing and other imitative domestic play It is commonly admitted that little girls respond earlier than boys to training in social manners and receive more of it, but whether that was true of these children is not known In these groups the only persistent left-handed eaters were boys

6 *Racial Differences*

Five of the children in this population were negroes, and two were Chinese The older negro children showed more ambidexterity and left-handedness than the average for the group, their indices being 027, —214, and 1665. The two younger negro children showed high right-handed indices, 71 for a boy and .73 for a girl

The two Chinese children, one a girl and one a boy, showed indices of 0673 for the girl and 60 for the boy

7 *Sibling and Twin Data*

Mirroring in handedness of twins is commonly offered as evidence of the hereditary basis of handedness This deduction has been based on relatively few isolated cases, chiefly young twins who tend to be more ambidextrious in general than older children

Among these nursery school children were two pairs of twins, one set of identical boy twins, and one brother-sister pair. There were also four sets of siblings with two members each The handedness indices for these twin and sibling pairs are given in Table 4.

A, the left-handed member of the *R* twins was in all respects less mature than his brother and had been placed with a younger age group Among

TABLE 4

Twins		Indices	Siblings		Indices
The *R* twins	*A*	—.32	The *R* sibs	*A*	603
(identical)	*B*	.49	(sisters)	*B*	674
The *T* twins			The *I* sibs	*A*	436
(brother and sister)	girl	56	(sisters)	*B*	631
	boy	—.117	The *S* sibs	*A*	271
			(brothers)	*B*	—674
			The *A* sibs	*A*	451
			(brother and sister)	*B*	—069

these children the greatest degree of "mirroring" was found in the *S* sibs, brothers, 11 months apart in age.

Obviously, many more pairs would be needed to establish mirroring as a more frequent handedness pattern in twins or sibling pairs than among children in general at these early age levels.

8. *Left-handedness*

Left-handedness proved to be less frequent and much less dominant or consistent among these children than right-dominance. Six cases or 11 1 per cent fell below the ambidextrous line. Updegraff (5) reported five out of 40 or 12.5 per cent of her nursery cases to be left-handed In the Manhattanville population, only one of the 44 children was consistently left-handed, all others of the six in this group were not far from the ambidextrous line. The median index for the six cases was —.175. For the right-handed, .55. In the two-year group any child with strong dominance was right-handed.

Who are these Left-Handed Children and Ambidextrous Cases? The only child in the entire population who showed a high index of left-handedness was a member of the three-year group, with an index of —.674. This child was new to the nursery, arriving several days after the observations began. His mother pointed to him the first day exclaiming, "You see he's left-handed." Later she indicated that she wanted him to eat with his fork and spoon held in the left hand.

Various facts about the six left-handed children and four others just a little over the ambidextrous line are given in Table 5.

These left-handers proved to be younger children for the most part, new to the school, or older on entrance than the typical child in the school. Four of the "lefties" or two-thirds of the group were boys Three of the five negro children in the population fall into this left-handed and ambi-

TABLE 5

	Age	Sex	Handedness index	Other data
1	2- 7	girl	—0422	New to the school. Eating habits about 50-50
2.	3- 3	boy	— 674	New to the school Data given in the paragraph above
3	4- 5	girl	— 069	In nursery school since age 3-5, but considerable absence.
4.	4- 1	boy	— 117	A twin In the nursery a year and a half
5	4- 3	boy	— 32	A twin Mentally immature, does not respond well to training Entered the nursery at age 3-5
6	4- 3	boy	— 214	A negro child, new to the nursery Strong left-handed eating tendencies, otherwise ambidextrous
7	2- 0	boy	0157	New to the school
8.	3- 7	girl	0637	Chinese New to the school
9	3-11	boy	1665	Negro child, new to the school
10	4- 2	girl	027	Negro child, new to the school.

dextrous group. The six left-handed children have a median age of 4-2, whereas the average of the population leaving out these six is 3-9 Left-handedness, of course, is not taught nor encouraged so early as right-handedness.

The left-handed proved to be more strongly left-dominant in eating than in any other trait, especially Case No. 6 in the list. Left-dominance tends to persist once a direction is taken In these children, left-handed eating habits may signify a "let alone" policy, indifference or tolerance on the part of parents or even actual encouragement as in the case of the mother of boy No. 2 In some cases, left-handed eating would suggest lack of any definite training more than anything else Once the habit is set up, it is only natural for the child to resist any attempts at conversion.

There is no need to assume that these children near the ambidextrous line are fated to be ambidextrous through life. They are now in an intermediate stage in development, and pretty certain to become more strongly right or left dominant with increasing age, depending upon circumstances in their training.

Left-handedness is so easy to discourage between the ages of one and three, that most parents succeed in throwing the balance toward right-dominance without much difficulty Relatively few children remain whose parents do not strengthen the child's right-handedness, at least for eating.

9. *Stuttering and Handedness*

Clinical studies have repeatedly shown an association between speech hesitancy or stuttering on the one hand and low manual left dominance or partially converted dominance on the other Whether this association is causal, that is, the speech defect attributable to the manual condition, has never been wholly established.

Speech is learned behavior, developmental in character. Speech controls and manual dominance develop coordinately In fact eating and speaking use some of the same motor mechanisms Stuttering first appears in the majority of cases between the ages of three and four, the period during which manual dominance is becoming confirmed Speech in nursery age children is usually accompanied by gesture

Some experts attribute stuttering to enforced shift in manual dominance, *believing that the methods used have more to do with the onset of stuttering* than the change itself It has been found that as soon as dominance is re-established the stuttering tends to disappear, at least in the early age levels

Among the children of this study, Case No. 6 in the left-handed list with a handedness index of — 214 was the only child who persistently stuttered Case No. 5, a boy with an index of —.32, seemed retarded in speech for he talked very little, using when he did speak only single words. Some of the younger children had not yet reached the stage where they could express their ideas very well in spontaneous language These children were too young to have acquired a tendency to stutter

Although the index for boy No 6 is similar to that of several other "lefties" in the group, especially boy No. 5, boy No 4, and girl No 3, his pattern differs from theirs in several important respects He is the only child among the left-handed cases who shows a wide discrepancy between eating and other manual traits. His indices for all eating habits, spoon, fork, glass and fingers are as follows spoon, —1 00, fork, — 6, glass, —1.00, fingers, — 6 For all acts *except* eating his index is 0246, for throwing a ball it is —.25, *and for random acts observed,* 00 The nearest matchees to this boy, cases Nos 4 and 5 show the following indices for eating No. 4, — 29, No 5, —.077 Case No. 2, with an index of —.674, the most consistently left-handed child in the entire population does not stutter

It would be rash to theorize on the basis of a single case, but in this one left-handed stuttering case at least, there is a marked discrepancy between dominance in eating and other manual acts Other left-handers, showing greater consistency among all manual traits, do not stutter The mother of the stuttering boy was not available for questioning as to his development in handedness and speech It may be that lack of consistency in hand usage rather than ambidexterity or enforced changing over, especially when the eating habits are pretty well "fixed" may be a causal factor in stuttering Usually in most "changing over" the person doing the retraining tends to work on only one skill such as eating or writing, producing highly inconsistent handedness patterns in the individual retrained It may be that stuttering occurs chiefly in children who have been definitely taught or encouraged to use the left hand for certain stereotyped acts, but at the same time remain near the ambidextrous line or are right-handed in other skills

10. *Effects of Training*

In all the observations that were made, those acts that are most strongly influenced by the child's parents or teachers tended to show high right-handed indices These acts were eating with spoon and fork, writing or crayoning, and to some extent throwing. Young children tend to be right-handed in the trained things, either-handed in the untrained. Right-handedness appears to be learned behavior, initiated largely through the use of eating implements. Children who get an early start in right-handed eating tend to become right-handed There tends to be more right-handedness in acts that are subject to social censure when performed with the left hand In acts that would seem to demand comparable dexterity, for example eating with a spoon and putting pegs in a board, young children tend to be right-handed in the former, but ambidextrous in the latter chiefly because the first is taught, the second is not

In summary, the points that favor explanations of manual dominance in terms of training are.

1. The differences between eating with implements and eating with the fingers
2. The differences between eating habits and other acts requiring considerable dexterity
3. The differences in degree of dominance between those who have remained a longer time in the nursery compared with a shorter period of time
4. The wide difference in the two-year group between eating with a spoon and "other" activities
5. Differences between boys and girls which appear to have a social basis.

11. *Training Influences*

Although all the staff of the nursery school appeared to be committed to a "hands off" policy in matters of hand dominance, certain direct and indirect training influences appeared to be at work right along Some of the younger children had scarcely used silverware before entering the school Teachers tended to place the spoons for the two-year-olds to the right of the bowl or within the bowl on the right hand side. The three- and four-year-olds found the spoon or fork on the right hand side of plate or dish. The drinking cup and glass tended to be placed to the right or to be handed to the child toward his right side oftener than toward the left. Teachers sometimes gave uncertain children or poor eaters help by lifting the right arm, or placing the spoon in the right hand On a few occasions a child was told, "Use your other hand," when he took the spoon in his left hand. There was never any emotional disturbance over this matter because the teachers made the suggestion in calm, matter-of-fact tones. No child was ever observed corrected for left-handed "finger feeding," though they were sometimes cautioned to use fork or spoon instead of the fingers New, incoming children sat alongside the others and watched how the others ate. They seemed to want to imitate the teacher and to eat the right way, so as to merit approval from the teacher and other children. This social conditioning appeared to be a strong element in the whole training program. It is a tribute to the good training influences of the school that new children tended to "fall in line" as quickly as they did Naturally some children tended to "catch on" to approved procedures faster than others.

The act of eating seemed such an impressive factor in establishing right-handed habits, that just as a check a count was made of the number of times during the lunch period one three-year-old boy lifted spoon and fork to his mouth. This child happened to be one of the poorer eaters who did not ask for second helpings. The actual number of moves was· fork 10, spoon 7, cup 8, fingers 24, or 49 moves in all

More extensive studies are needed to confirm these suggested findings, using a larger number of cases, even more observations, and control groups if possible, to determine more precisely the effects of training on the development of hand dominance.

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THE CORRELATION BETWEEN PERSEVERATION TEST SCORES AND THE INTELLIGENCE QUOTIENT AN EXPERIMENTAL STUDY*

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A INTRODUCTION

This study was conducted in an attempt to discover whether any correlation exists between intelligence, as measured by psychological examinations and expressed in terms of the intelligence quotient, and perseveration, as measured in certain sensory-motor tests

Though the use of perseveration tests has not been wide-spread, it has been conceded by some psychologists that they are among the best instruments yet devised for the objective measurement of character integration (1, 2, 3, 4, 5, 6, 12) Since the subjects in a great majority of the studies of perseveration have been adult patients in mental hospitals or institutionalized dependent or delinquent children, the implication is that such tests would be most valuable in indicating extreme instances of abnormality Nevertheless, it seems that a perseveration test or similar instrument which would yield a measure of character integration for children might make possible the discovery and treatment of some of those minor maladjustments which often constitute an impediment to academic progress and social efficiency.

Such practical applications must wait, however, upon the selection of a battery of tests which will yield a perseveration score which is truly indicative of a permanent element and not unduly influenced by such factors as intelligence and speed

Whereas the more recent studies have been concerned primarily with the relationship of perseveration to character, the term "perseveration" has not always had the same meaning ascribed to it at present It seems to have been first used by Neisser, a German psychiatrist, to indicate instances of the abnormally persistent repetition or continuation of an activity after it should normally have been completed

The concept of perseveration seems to have been introduced to psychology by G. E Muller and A Pilzecker in their study of memory in 1900 They said that every idea has a tendency to remount spontaneously into conscious-

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ness This tendency, they stated, is strongest when attention has been directed intensely upon the idea, it increases if the idea, or series of ideas, is soon repeated.

In 1906 the Dutch psychologist G Heymans and the psychiatrist E. Wiersma devised the first definite and serviceable tests of perseveration. These were administered to patients in a mental hospital and to a group of normal subjects Wiersma's results led to the inference that perseveration is increased by melancholia and diminished by mania (16)

Later tests took into consideration the motor as well as the sensory aspect of perseveration On the basis of his own and other investigations, Jones (9) considered the motor tests the best measures of perseveration; yet he concluded that not even these really measure perseveration for the manic group

Recent investigations have been based upon a more inclusive concept of perseveration. The theory of mental inertia proposed by Spearman (11) seems to provide the best explanation thus far proposed for the fact that a perseverative tendency is manifested in the realms of sensations, movements, and ideas. *According to the theory of inertia, the 'g'-factor and the factor* of perseveration are both concerned with mental energy Stephenson (12) interprets this theory to signify that the 'g'-factor may be regarded as an individual's available mental energy and the '*p*'-factor as the amount of inertia of that energy.

We should not be justified in assuming that Spearman's '*g*' is synonymous with intelligence as measured in the Stanford-Binet examination in spite of Stephenson's apparent use of '*g*' and 'intelligence' inter-changeably and Earle's statement (7) that, "'*g*' is taken to be roughly equivalent to the 'general intelligence'." However, since there are no available data pertaining to the relationship between perseveration score and intelligence quotient, we may consider the meager (and somewhat contradictory) facts regarding the relationship of the '*p*'-factor to '*g*'.

The results of one of Cattell's earlier investigations (3) indicated that high perseveration tended to be associated with low '*g*', especially with feeble-*minded persons. Stephenson also found a negative*, though small, correlation between perseveration scores and '*g*' in one of his studies (13). In a later publication, however, Cattell seems to agree with Spearman's view that, "'*P*' and '*g*' vary independently of each other" (11). Stephenson also has stated (12) that, ". . . normally, '*p*' and '*g*' have no correlation "

B The Subjects

The data for this study were derived from two sources 15 pupils in the ungraded division (a special class for mentally retarded children) at the William Penn School, and 31 children in grades three to eight at the same school were the subjects

The experimental group consisted of 23 girls and 23 boys. The children's chronological ages ranged from eight years six months to fourteen years six months The range of their mental ages was from six years two months to sixteen years seven months The intelligence quotients of the subjects ranged from 50 to 140

For the purpose of this study, the subjects were chosen to represent three levels of ability below average, average, and above average. This classification was based on the results of individual psychological examinations administered by qualified psychologists The Stanford revision, form *L*, of the Binet scale was the intelligence test used.

Table 1 presents the classification of the three groups of subjects on the bases of sex and chronological age.

TABLE 1
Classification of Subjects Into Sub-Groups

Group *A* Below average intelligence				Group *B* Average intelligence				Group *C* Above average intelligence			
No	Sex	*CA*	*IQ*	No	Sex	*CA*	*IQ*	No.	Sex	*CA*	*IQ*
1.	M	12- 3	50	24	M	12- 4	102	34.	M	12- 3	115
2	M	14- 6	56	26	M	14- 6	104	31	M	14- 5	111
3	M	13- 4	57	21	M	13- 5	99	36	M	13- 5	116
4	F	11- 2	62	28	F	11- 2	106	42	F	11- 4	123
5	F	10- 5	65	30	F	10- 5	109	45	F	10- 4	126
6	M	12- 8	66	19	M	12- 8	97	40	M	12- 7	121
7	F	13- 2	66					39	F	13- 2	119
8	F	13-11	68	29	F	14- 0	107	37	F	13-10	117
9.	M	8-11	69	25	M	8-11	102	46	M	9- 0	140
10	F	11- 4	71	20	F	11- 3	98	38	F	11- 4	118
11	M	9- 5	73	27	M	9- 5	105	44.	M	9- 4	124
12.	F	9-10	73	16	F	9- 9	92	33	F	9-10	112
13	M	10-10	76	23	M	10-11	101	41	M	10-10	122
14	F	8- 7	77	18	F	8- 6	96	32	F	8- 6	112
15	F	9- 2	78	22.	F	9- 2	100	35	F	9- 3	116
				17	M	13- 6	93	43	M	13- 8	124

C. The Tests

The four perseveration tests used were those suggested by Cattell (2) for use with children

Test 1	Writing *abc*'s
Test 2	Drawing triangles
Test 3	Writing *w*'s
Test 4.	Naming colors

D. The Procedure

The tests were administered individually The actual working time for the four-test battery was five and one-half minutes Since rest periods were provided between the sections of each test, however, the length of the testing period varied between 15 and 20 minutes for each subject.

For the first section of Test 1 the child was asked to write the letters '*abc*'. The directions were·

> "When I say 'go,' I want you to write the letters *abcabc* in these spaces (pointing to the first line on the work-sheet) as quickly as you can Write them just like this (showing sample card) If you fill this line, go on to the next one Go on writing until I say 'stop' Then put down your pencil Write as quickly as you can, but write carefully so that your paper looks like this (pointing to sample card) If you make a mistake, cross it out and go on writing *as quickly as you can* Do you understand? Ready? Go"

The working time for this, and for each section of the four tests, was 15 seconds. A rest period of several seconds followed Next the subject wrote the capital letters *ABC* as quickly as possible for 15 seconds In Section *C*, he wrote small letters In Section *D*, the capital letters were written again In the final sections of this test, the subject wrote *aAbBcC* for two 15-second periods.

The score for each section of the test was the number of letters written in 15 seconds, minus any errors The scores for the first four sections were added to obtain the '*x*' score The scores on Sections *E* and *F*, in which small and capital letters alternated, were added, twice this sum was taken as the '*y*' score The total score for this test was '*x*' over '*y*'.

In Tests 2 and 3 the procedure was similar The task in Test 2 was to draw triangles, some pointed upward, others downward. In the two final sections the two types alternated In the final sections of Test 3 the letter '*w*' was to be written backwards instead of in the normal left-to-right direction

There were 60 red, blue, green, and yellow circles on the chart prepared for Test 4. The subject was asked to point only to the red and blue circles and say their names as quickly as possible. In Sections *A*, *B*, and *D*, the colors were to be correctly named. In Sections *C* and *E* the task was to call all the red circles blue and the blue ones red. As in the other tests, the subject was urged to go as quickly as possible.

The score for each section was the number of red and blue circles named (normally or in reverse) within 15 seconds, minus any errors, insertions, or omissions. The sum of the scores for the sections in which the colors were correctly named was divided by the sum of the scores on the two sections in which the color-names were reversed.

This method of dividing the sum of the scores on the unimpeded parts of the tests by the sum of the scores for those activities which were slowed down by reversal or alternation was chosen because its use eliminates or greatly minimizes the speed factor.

The sum of each individual's scores on the four tests was taken as his total perseveration score. This total was the figure used in investigating the correlation between the intelligence quotient and the perseveration test score.

E. THE RESULTS

An examination of the scores (Tables 2, 3, and 4) discloses that the highest total score was made by a member of the group of subjects having intelligence quotients below the range of the average. The lowest score was made by a member of Group C, comprised of subjects having intelligence quotients above the average range.

TABLE 2
SCORES ON THE PERSEVERATION TEST GROUP *A*

Subject No	*abc*	Δ	ω	Colors	Total scores
1	1.2304	1.4733	1.9264	1.3687	5.9988
2	1.5958	1.4269	1.3486	2.2727	6.6440
3	1.7962	1.6834	1.4937	1.8972	6.8705
4	1.6427	1.1434	1.3641	1.7432	5.8934
5	1.0000	1.5000	1.6667	1.0357	5.2024
6	1.5000	1.2639	1.1739	1.3333	5.2711
7	1.2222	1.0500	1.5833	1.8261	5.6816
8	1.6346	1.3572	1.5833	1.5740	6.1491
9	1.8267	1.3652	1.7296	1.4750	6.3965
10	1.1538	1.0000	1.6364	2.0000	5.7902
11	1.6233	1.3691	1.5326	1.9794	6.5044
12	1.7130	1.5257	1.4892	1.8273	6.5552
13	1.8750	1.8667	1.4167	1.4000	6.5584
14	1.4792	1.7925	1.6376	1.8175	6.7268
15	1.1136	1.1667	1.7143	1.7647	5.7593

TABLE 3

SCORES ON THE PERSEVERATION TEST GROUP *B*

Subject No	*abc*	Δ	*w*	Colors	Total scores
16	1 4723	1,5000	1 4333	1 7647	6 1703
17	1 5455	1 3333	1 4333	1 3767	5 6888
18	1 3849	1 3750	1 4225	1 4873	5 6697
19	1 3143	9889	1 4167	1 4639	5,1838
20	1 2767	1 1967	1 3223	1 2433	5 0390
21	1,6667	1 5983	1 4839	1,4866	6 2355
22	1 3064	1 2639	1 2498	1 3462	5 1663
23	1 2308	1,2500	1 7368	1,3171	5,5347
24.	1 2983	1 3491	1 3233	1 3618	5 3315
25	1 4167	1 5000	1 4333	1 7647	6 1703
26	1 2157	1,0750	1,3223	1 3736	4 9866
27	1 3333	1 2667	1 3578	1,3926	5 3504
28	1 5455	1 0333	1 5294	1 5000	5 6082
29	1,2461	1,3134	1 3787	1 4264	5 3646
30	1 2143	1 2727	1,4667	1 4000	5 3537

TABLE 4

SCORES ON THE PERSEVERATION TEST GROUP *C*

Subject No.	*abc*	Δ	*w*	Colors	Total scores
31	,9545	,9672	1 2139	1,4875	4 6231
32	1 4667	1 3774	1 4923	1 6234	5,9598
33	1 2967	1 3626	1 4707	1,3943	5 5243
34.	1 0472	9769	1 2498	1 4167	4 6906
35.	1 2729	1 3233	1 2923	1 3467	5 2352
36.	1 2062	1 1164	1,2493	1 2764	4 8483
37.	1 1337	9937	1,1167	1 3048	4 5489
38	9894	1 2765	1 4143	1 6125	5 2927
39	1 2223	9919	1 2500	1 2250	4 6892
40	1 1467	,9993	1,1333	1 2500	4 5293
41.	1,3823	1 3427	1 2738	1 4556	5 4544
42	1 1334	1 2823	1,2656	1 5148	5 1961
43	9889	1 2286	1,4643	1 3250	5 0068
44	1,2664	1 3043	1 3333	1 2936	5 1976
45	9750	9423	1 5600	1 5384	5 0157
46	1,4834	1 4333	1 4647	1 4748	5.8562

The averages for the three groups are given in Table 5.

When the average intelligence quotients and perseveration scores of the three groups are compared, we discover that the highest average perseveration score is earned by the group having the lowest average intelligence quotient. The lowest average score is that of the group having the highest average intelligence quotient.

The differences between the average scores of the groups follows the same trend as the differences between their average intelligence quotients That is, the difference between the average scores of Groups *A* and *B* (like

TABLE 5

For Group A	
Mean Chronological Age	11 years 3 months
Mean Intelligence Quotient	67 1
Mean Perseveration Score	6 1334
For Group B	
Mean Chronological Age	11 years 4 months
Mean Intelligence Quotient	100 7
Mean Perseveration Score	5 5235
For Group C	
Mean Chronological Age	11 years 3 months
Mean Intelligence Quotient	119.7
Mean Perseveration Score	5 1042

the difference between their average intelligence quotients) is greater than the difference between the average scores of Groups *B* and *C*.

The correlations between intelligence quotients and perseveration scores, translated into product-moment coefficients, are given in Table 6.

TABLE 6

For Group *A*	r = 10
For Group *B*	r = —26
For Group *C*	r = 10
For Groups *B* and *C*	r = —40
For All Groups	r = —693± 05

There was very little difference between the perseveration scores of boys and girls. This similarity is in accord with the findings of Pinard (10). The average scores for the sub-groups and for the entire experimental group are given in Table 7.

TABLE 7

	Girls	Boys
Group *A*	5 9697	6 3205
Group *B*	5 4817	5 5602
Group *C*	5 1827	5 0258
All Groups	5 5474	5 6057

The inter-correlations between the scores on the sub-tests in the battery are given in Table 8

TABLE 8

	Group *A*	Group *B*	Group *C*
1 *abc*—Δ	49	44	82
2 *abc*—colors	05	58	—12
3 *abc*—*w*	—42	36	32
4 Δ —*w*	00	21	49
5 Δ —colors	—14	42	20
6 *w* —colors	—24	46	54

The correlations of the sub-test scores with the total scores are given in Table 9.

TABLE 9

	Group *A*	Group *B*	Group *C*
1 *abc*—total	65	70	62
2 Δ —total	67	73	84
3 *w* —total	—21	74	80
4. colors—total	48	68	56

F Conclusions

An examination of the results reveals that the perseveration test used, though it was chosen because it seemed suitable for the range of abilities in the experimental group, is a less reliable instrument for Group *A* than for Groups *B* and *C*

While the number of subjects was small, and the distribution was carefully planned to include three well-defined levels of ability rather than to approximate a normal (unselected) population, the results of this experiment do indicate clearly that there is a negative correlation between intelligence quotients and perseveration scores when a reliable test is used The author would suggest the elimination of the "*w*" test for the low intelligence group.

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A FURTHER OBSERVATION ON THE EFFECT OF PHYSICALLY ENFORCED INACTION ON THE ACTIVITY LEVEL OF THE RAT*

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In an earlier article Siegel (5) has reported a complex relationship between interval of physically enforced inaction and subsequent activity in the rat Animals were measured with respect to gross bodily activity after varying periods of confinement in a movement-discouraging chamber. Following 0-hours confinement (i.e , after the relative freedom of the home cage) a mean activity score of 245 was obtained[2] A mean score of 202 followed 6-hour confinement in the movement-discouraging chamber A score of 221 followed 12-hour confinement. Mean activity after 24-hour confinement was 266. From these results it was concluded that the relationship between physically enforced inaction and subsequent activity level is not simple

Perhaps the most striking finding both behaviorally and statistically, was the depressing effect of 6-hour restraint The experiment reported here represents an attempt to repeat this last observation and to examine the effect of the time of day at which inaction is introduced.

A Subjects and Apparatus

Sixteen male albino rats of the Sherman strain served as subjects. Each had a history of experience in a motivational problem which employed a Skinner box (6). Ages ranged from 185-205 days (beginning of the experiment). Weights ranged from 305-430 grams, mean, 369 grams. Activity was measured in a photoelectric activity chamber described earlier (4). In its essentials it consists of a rectangular shaped box of inside dimensions, 22 ins. in length, 6 ins. in width, and 9½ ins. in depth. Locomotion of the animal from one end of the chamber to the other serves to interrupt a light beam, throwing a relay and thus operating an impulse counter The experimenter obtains a total count of the animal's excursions within some specified time interval The box has been shown to yield an odd-even

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[2] These units are somewhat arbitrary.

reliability coefficient of .869 (uncorrected). This value was obtained by correlating the total scores for four odd daily trials of half an hour's duration each with the totals for the four even daily trials.

Illumination was afforded by a single 60-watt daylight-simulating bulb which was suspended in a reflector 16 ins. above the box. A sound screen (electric fan) was used throughout the experiment. Daily temperature records were taken from a thermometer attached directly to the box. Temperatures varied irregularly between the extremes, 73 and 78 degrees Fahrenheit.[3]

The animals' normal living quarters were subject to the sun-determined, dark-light cycle. Each animal was individually housed in a cage, length, 15 ins., width, 9 ins., and height, 9 ins. In contrast with the confinement chamber, the animal's home cage provided a volume freedom of 1,215 cu. ins.

The confinement chambers were arranged in two banks of four each. Constructed of wood with a wire-mesh top and bottom, each compartment had the inside dimensions, length, 7 ins., width, 2½ ins., and height, 6 ins. (volume, 105 cu. ins.). The compartments discouraged almost all bodily movement.[4]

Food (Purina checkers) and water were available at all times in both the home cage *and the confinement chamber*. The latter provision is an essential condition to the avoidance of a confounding of variables, i.e., confusion of hunger and/or thirst needs with confinement effects in the measurement of subsequent activity. Each animal was given several days preliminary confinement experience. From the outset, *every* rat ate and drank freely in the confinement chamber. We can safely conclude that subsequent activity effects are not influenced by a state of hunger and/or thirst.

B. PROCEDURE

The animals were permitted four days to adapt to the activity box. On each of the four days, a half-hour trial was conducted. No records were taken during this period.

During the experiment proper a unique running schedule was observed. The rats were run in two sub-groups on alternate days. In every instance, the confinement period was so scheduled as to terminate with the introduction of the animal into the activity chamber. That is, the rat was placed in the restraining chamber a specified number of hours before running and, with the expiration of this period, he was taken out and placed immediately in the activity box. Activity was then measured for a half-hour interval.[5] To eliminate any persistent confinement effect, the schedule was designed to permit each animal a full day's home cage freedom between test trials.

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[3] The temperature of the experimental room was held within this range by thermostatic control.

[4] For the most part, the animal lies passively on one side.

Two of the activity chambers described above were employed. They were equated for difficulty by the following calibration technique. A galvanized tin arm, 14 in. in length and 3½ ins. in width, was attached by one end to a variable speed synchronous motor. This assembly was mounted on a stand directly above the center of the activity chamber in such a fashion as to permit the arm in revolving to sweep through and interrupt the light beam. The tension spring on the relay arm of each apparatus was then adjusted until each relay would just follow the revolving arm when set to interrupt the beam 140 times per minute.[6] In this experiment, equality of difficulty in the two instruments is not actually critical. Each animal was given equal experience in each box and the results totalled. Discussion of the calibration technique is here included to indicate a direct method to the experimenter with need for such control.

The experimental schedule is indicated in Table 1.

TABLE 1
EXPERIMENTAL SCHEDULE

Day	Box	Animals *A-H* Confinement	Run	Box	Animals *I-P* Confinement	Run
1	1	5 A.M.-2:30 P.M.	11 A.M.-3 P.M.	2	None	11 A.M.-3 P.M.
2	2	None	11 A.M.-3 P.M.	1	5 A.M.-2:30 P.M.	11 A.M.-3 P.M.
3	2	5 A.M.-2:30 P.M.	11 A.M.-3 P.M.	1	None	11 A.M.-3 P.M.
4	1	None	11 A.M.-3 P.M.	2	5 A.M.-2:30 P.M.	11 A.M.-3 P.M.
5	1	11 A.M.-8:30 P.M.	5 P.M.-9 P.M.	2	None	5 P.M.-9 P.M.
6	2	None	5 P.M.-9 P.M.	1	11 A.M.-8:30 P.M.	5 P.M.-9 P.M.
7	2	11 A.M.-8:30 P.M.	5 P.M.-9 P.M.	1	None	5 P.M.-9 P.M.
8	1	None	5 P.M.-9 P.M.	2	11 A.M.-8:30 P.M.	5 P.M.-9 P.M.

Some clarification of the schedule is necessary. A concrete case will serve. Rat *A* on Day 1 was confined between the hours 5 A.M. and 11 A.M. (6 hours). His activity was then measured from 11 A.M. until 11:30 A.M. Rat *B* on Day 1 was confined between the hours 5:30 A.M. and 11:30 A.M. His activity was measured between 11:30 A.M. and 12:00 A.M. The other subjects may be similarly fitted into the schedule. No confinement implies freedom of the home cage.

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[5] The observational interval was actually 29 minutes in duration. One minute between trials was consumed in removing one animal and introducing the next.

[6] This rate is well above experimental demands.

C. RESULTS

Table 2 is a master table. The two sub-groups have been combined in single distributions by confinement periods. Each score represents the total activity (i.e., for the two half-hour periods) for a given animal under the indicated conditions of previous confinement. Means and standard deviations are also presented. The *t* values were computed by means of Fisher's technique (1, p. 38-44)

TABLE 2

	Confinement 5 A.M.-2.30 P.M.		Confinement 11 A.M.-8.30 P.M.	
Rat	0 Hours	6 Hours	0 Hours	6 Hours
A	45	22	40	55
B	82	76	84	26
C	29	57	17	8
D	59	58	90	50
E	15	26	36	32
F	48	55	94	83
G	42	43	49	51
H	45	59	81	43
I	50	55	31	20
J	35	41	28	18
K	56	40	57	27
L	66	76	39	46
M	21	38	26	14
N	51	60	57	85
O	23	11	27	14
P	53	29	77	45
Mean	45.0	46.6	52.1	38.6
SD	17.5	18.6	25.6	23.2
Difference	1.6		13.5	
t Value	.445		2.455	

D. DISCUSSION

Inspection of Table 2 reveals that 6-hour confinement in the late morning to early evening period (11 A.M.-8.30 P.M.) is followed by a diminution in general activity. Contrast of the 6-hour confinement score (38.6) with the control score (52.1) yields a difference of 13.5 The *t* value (2.455) indicates significance between the 2 per cent and 5 per cent levels[7] This constitutes a confirmation of our original observation Here the decrement is 26 per cent. In our first experiment, the decrement was 18 per cent[8] An essential agreement is indicated. It is of further interest to note that this agreement occurs in independence of differences in strain, age, and body weight. The original effect was obtained with younger animals (85-95 days of age). Weights varied between the limits, 232 and 295 grams, mean, 265 grams Finally, the other strain was predominantly Wistar The inhibitory effect of 6-hour confinement when introduced between the hours, 11 A M and 8 30 P M , seems to be genuine and to some extent independent of the three variables, strain, age, and body weight

When the confinement period occurs between the hours, 5 A.M. and 2:30 P.M , the effect does not appear From Table 2 we note that 6-hour confinement is followed by a mean activity score of 46 6 with a control score (0 hours confinement) of 45 0 The *t* value (445) indicates that the difference obtained is far from significant

In view of the difference in time of day at which activity was measured, we cannot directly compare the two 6-hour confinement performances It is both feasible and meaningful statistically however to compare the two difference distributions obtained by contrasting each 6-hour confinement distribution *with its own control* That is, we can apply Fisher's *t* test in evaluating the difference between two distributions of differences This constitutes a test of relative significance. Stated otherwise, our null hypothesis is: The difference between 0-hours confinement and 6-hour confinement for the period, 11 A M to 8 30 P M , is not significantly greater than the difference between 0-hours confinement and 6-hour confinement for the period, 5 A M to 2 30 P M When these operations are performed, a relative difference of 15.1 is obtained The *t* value is 2 526. With 15 degrees of freedom, this value is significant at the 2-5 per cent level We can safely conclude that the time of day of physically enforced inaction exerts a genuine influence

Hunt and Schlosberg (2) have recorded the activity cycle of the rat under conditions roughly comparable to ours, i e., with *ad lib* feeding during a dark-light cycle. They report greatest activity between the hours 7 P M and 7 A.M., with the least activity occurring between the hours 7 A M. and 7 P M Further, their graphs indicate that the animal is slightly more active from 11 A M to 8:30 P M than from 5 A M to 2:30 P M. Our informal observations have suggested an even more marked differential In our experience, the rat is almost totally inactive between the hours 5 A M. and 2 30 P M [9] It is hardly surprising that inactivity "artificially" induced during that period should have no effect on subsequent activity level

We may tentatively conclude that when a 6-hour period of physically en-

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[7] From Snedecor (7, P 65), the *t* value at the 2 per cent level is 2 602 with 15 degrees of freedom At the 5 per cent level, the *t* value is 2 131

[8] Slight differences in apparatus and methodology make absolute comparisons impossible

[9] In an unpublished study which employed the rotating activity wheel, Dr O L Lacey of this department has made a similar observation

forced inaction is introduced *during a "natural" period of relatively high activity*, the rat's subsequent activity level is depressed. This assumes that physical restraint forces a genuine relaxation, i.e., is not attended by emotional resistance. As we have indicated earlier this seems to be true. For the most part the animal lies quite passively on one side when confined for a 6-hour interval.

In the last analysis this effect is perhaps best understood in terms of the hypothesis popularized by Jacobson (3). In the instance of the rat, physical restraint for short periods of time serves to minimize environmental and intraorganic stimulation with the greatest gain occurring in the realm of kinesthesis. In the absence of marked stimulation, the nervous system of the animal becomes quiescent. This central state is then reflected in gross bodily activity.

The above hypothesis lends itself easily to further experimental assay. *Any condition that tends to reduce environmental stimulation should be attended by a diminution in subsequent activity.* For example, one might examine the effect of producing experimentally a uniformly neutral visual and/or auditory environment.

E. SUMMARY

Sixteen male albino rats were subjected to a 6-hour period of confinement in a movement-discouraging chamber. When the confinement interval occurred during the period from late morning to early evening, subsequent activity showed a 26 per cent decrease under the activity of the control period (no prior confinement). When the confinement period was introduced in the early to late morning period, no difference in activity was observed relative to the control. Explanation is offered in terms of Jacobson's Relaxation Hypothesis.

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THE DEVELOPMENT OF VERBALIZED SPACE IN THE YOUNG CHILD*

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A THE PROBLEM AND PROCEDURE

The present investigation deals with the child's verbalized manifestations of the sense of space (not with his total concept of space) from 18 through 48 months Two methods were used to gather the material One was observation of children in the Guidance Nursery of the Yale Clinic of Child Development as they indulged in spontaneous or directed play All spontaneous verbalization involving or even implying space was recorded stenographically from behind a one-way vision screen Children were thus observed through an entire school term, from September to June. Such observation of spontaneous verbalization seems in many ways to be one of the most useful methods for studying the child's concepts of space.

The second method used was to ask these same children, and others, a series of questions (see Table 1) dealing with various aspects of space Children were questioned individually and were asked the entire series of questions at one sitting Questions were asked over a period of two school years. There were 20 children questioned at 24 months, 25 each at 30, 36 and 42 months, and 20 at 48 months Questioning before 24 months was not productive Subjects ranged from average to superior in intelligence and were from homes of somewhat above average socio-economic status The questions asked are reproduced in Table 1

B FINDINGS

Analysis of these data reveals consistent trends in the development of the sense of space in the young child. The more common concepts of space seem to come in at about the same relative age for most children and in a rather definite order

1 *The usual order for the appearance of the most common space words.* Table 2 lists the words used most frequently in spontaneous verbalization Table 3 indicates the words and phrases which appear (responsively) in the

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TABLE 1

SPACE QUESTIONS

1. Where is mummy?
   Where is daddy?
2. Where do you live?
   Where is that?
   What is it near?
3. What street (city, state, country) do you live in?
4. Where do fish live?
   Where do angleworms live?
   Where do birds live?
5. Where do airplanes fly?
   Where do trolleys go?
6. Where is the roof? The cellar?
7. Where are chimneys?
8. Where do you sleep?
   Where is that?
9. Where does mummy cook your dinner?
   Where is that?
10. Where do you eat your dinner?
11. Where do you like to play?
12. Where do you go for vacation? (In the summer?)
    Where is that?
    How do you get there?
    What way do you go to get there?
    What do you go by on the way?
13. Where do you go on Sunday?
    What way do you go to get there?
    What streets do you go on?
    What do you go by?
14. Do you go to visit your grandmother?
    Where does she live?
    Where is that?
    What way do you go to get there?
15. What is under the floor?
    What is above the ceiling?
16. What way do you go to come here from your house?
    What streets do you come on?

question situations. These responsive words are listed in two separate categories: (*a*) those most frequently used and (*b*) those less frequently used but still conspicuous in most cases. There is considerable correspondence in the two situations. The child's *space* vocabulary at any given age can be determined by reading the table in vertical direction under the age headings.

Table 4 gives the development of space verbalization in one individual child observed daily from 13 months to 25 months.

2. *The age at which 50 per cent or more of the subjects were able to answer the several questions* here asked is indicated by italicized figures in

TABLE 2

Words Used Most Frequently In Spontaneous Verbalization In Nursery School Situation

	18 months	21 months	24 months	30 months	36 months	42 months
Up	x	x	x	x	x	x
Down	x	x	x	x	x	x
Off						x
Come				x	x	x
Gone	x	x	x	x	x	x
Go		x	x	x	x	x
On		x	x	x	x	x
Big						x
Here		x	x	x	x	x
All gone						
Where				x	x	x
There			x	x	x	x
Little						
Up here				x	x	x
In			x	x	x	x
Out				x	x	x
Other side						
Up high						
To				x	x	x
Home				x	x	x
Right				x	x	x
Way				x	x	
—— house				x	x	
Fall						
Way up				x		
In here				x		
In there				x		
Right here				x		
To —— (city)					x	x
Over					x	x
In the train						
Back						
Fit						
Over here						
Go (belong)						
Found						
Over there						
In school						
Bigger						
Larger						

TABLE 2 (*continued*)

	18 months	21 months	24 months	30 months	36 months	42 months
Littlest						—
Between						—
Way down						—
Way off						—
Outside						

*Items marked x appear also, at the same age, in answer to questions

TABLE 3

(*a*) Most frequent words ——— (*b*) Less frequent words , used in Answering Questions

	24 months	30 months	36 months	42 months	48 months
Outdoors	—				
Home	—	—	—	—	
On	—	—	—	—	—
In	—	—	—	—	—
At	—	—	—	—	—
Go	—	—	—	—	—
Gone	—	—	—	—	—
Down		—	—	—	—
To		—	—	—	—
Up in		—	—	—	—
There		—	—	—	—
Upstairs		—		—	—
Up		—			—
Here		—			
Up here		—	—	—	—
Up in		—	—	—	—
Far		—			
Far away		—			
Downstairs			—	—	—
Out			—	—	—
Where			—	—	—
Near			—		
Outside			—		
Come				—	—
Up on					—
Right there					
Right up there					
Right home					
Right down					
Down here					

TABLE 3 (*continued*)

	24 months	30 months	36 months	42 months	48 months
Up there					
Right in					
Right					
Way up					
By			———	———	———
On top of			———	———	———
Backyard					
Left					
Right					
This way					
Corner					
Down in					
Over					
To —— (city name)					
From					
Up on top					———
Next to					
Under					
Little					
Big					
Way					———
Out in					———
Around					
Right on					
Right by					
Down to					
Way far					
Way off					
Behind					

Tables 5 to 8 Outstanding is the marked spurt in the space concept at 2½ years. Whereas only three very simple space questions "Where is mummy?" "Where is daddy?" and "Where do you sleep?" can be answered at 2 years, 13 of the twenty-one other questions asked are answered at 2½ years

3 *Space concepts in general as they appear in answer to questions.*

a Questions about where certain things are located. To simplify the presentation of results, tabulations of responses to specific space questions have been grouped as much as possible. The first of these groupings (Table 5) gives the percentage of children answering correctly, or otherwise, questions dealing with the location of familiar objects or people.

TABLE 4

DEVELOPMENT OF SPACE VERBALIZATION IN ONE INDIVIDUAL CHILD

13 months	Ride
15 months	Go Come
16 months	Where baw? Here baw
18 months	Oop (up) Where Doan? Go Go way
21 months	Kuddlup (get up) Down kitty Zum (thumb) in nere peese Arbers (rubbers) non Slipper noff Shoo y tokee non (Slipper off Shoes & stockings on)
22 months	Were Doan Pencoo? Fin' Doan pencoo Kitty go outdoors Were Kitty? Kitty on couch Oben dowah! Do' non, ha non, besh non Door ko ti (closed tight) Ow, ow (out) Uppa kool (up at school) Come in
23 months	Pick i up Into (putting letter into mother's hand) (Brushing objects, says) "Washa sings off Washa chair off" Baby turn roun Sun there? Where sun? Mamma go Bangor Uppa tairs Umfie (empty)
25 months	Doc D—— in nere? Fwont door? Daddy pech come pick up my maggie (magazine) There's daddy Nana's house (Knows in new house after one day which is Mummum room, Nana's room, Iwene's room) Kitty unna tove Peek a boo kitty Queeze out (squeeze out) Joanie kye in bed 'N lalee say c'ose a door 'N udder lalee say leave it open

Of these questions, the two simplest, having to do with the whereabouts of Mummy and Daddy are answered by two years. Most of the others are answered at 2½ years, the age when the largest number of space concepts seem to be added "Where is the cellar?" and "What is under the floor?" are not answered successfully till three years; and "Where do angleworms live?" not until four years

TABLE 5

PERCENTAGE OF CHILDREN ANSWERING CORRECTLY QUESTIONS DEALING WITH LOCATION OF FAMILIAR PERSONS AND OBJECTS

	2 yrs	2½ yrs	3 yrs	3½ yrs	4 yrs
Where is Mummy?					
No answer	35	16	—	4	10
Adequate	**65***	84	100	96	90
"Home" or "gone home"	30	**60**	64	72	65
Action as "Shopping"	—	12	24	4	5
"In ——" (place name)	—	8	—	16	5
Where is Daddy?					
No answer	35	24	—	12	—
Adequate	**65**	76	100	88	100
"At his office"	20	24	**54**	16	—
"At work" or "workin"	5	28	8	24	**40**
"At" or "In ——" (place name)	—	4	12	16	20
Action description	—	—	16	4	5
Connected with the war	—	—	24	12	20
Where do Fish Live?					
No answer or "don't know"	50	12	28	16	5
Good answer	25	**72**	72	80	95
"In the water"	15	**62**	52	64	75
"In the pond" (pool, lake)	—	16	12	12	20
"In the tub" (bowl)	—	8	—	4	—
Where do Birds Live?					
No answer or "don't know"	**75**	28	32	28	15
Good answer	25	**56**	68	72	85
"In the air" (sky)	—	20	—	8	10
"In trees"	5	20	16	16	35
"In nests"	—	4	28	28	10
"In bird-houses"	5	8	12	16	30
Where do Angleworms Live?					
No answer or "don't know"	**80**	44	56	36	35
Wrong answer	20	44	12	20	5
Good answer	—	12	32	36	**60**
"In dirt"	—	—	4	16	15
"In the ground"	—	4	4	16	20
Where do Airplanes Fly?					
No answer or "don't know"	**75**	20	12	12	15
Good answer	25	**72**	88	88	85
"Up in the sky"	10	32	48	36	**60**
"Up in the air"	10	20	16	28	5
"To ——" (destination)	—	—	12	32	20
Where do Trolleys Go?					
No answer or "don't know"	**95**	24	28	20	25
Good answer	5	**52**	72	76	70
"On the street"	0	28	20	20	15
"On tracks"	5	12	32	36	**60**
Destination	—	4	20	8	5

*In this and following tables, bold face type indicates the first age at which the percentage becomes normative, i e, over 50 per cent

TABLE 5 (*continued*)

	2 yrs	2½ yrs	3 yrs.	3½ yrs	4 yrs
Where is the Roof?					
No answer	85	28	24	20	15
Good answer	15	72	76	72	85
"On top"	5	20	28	24	—
"Right up there"	—	36	—	—	—
"On the house"	—	8	12	16	10
"On top of the house"	—	4	20	8	25
Where is the Cellar					
No answer or "don't know"	95	56	24	28	20
Inaccurate	—	—	24	—	—
Reasonably good answer	5	44	52	72	80
"Down" or "down there"	—	12	36	32	10
Some "down" answer	—	16	60	52	52
"At our house"	—	12	—	8	8
"Down in the basement"	—	4	8	8	—
Where are Chimneys?					
No answer or "don't know"	95	36	12	12	20
Good answer	—	56	68	76	80
"Right up there" or "Way up there"	—	36	12	8	10
"Up on top"	—	20	12	16	—
"On the house" or "on top of the house"	—	12	16	4	5
Some "roof" answer	—	8	32	24	65
What is under the Floor?					
No answer or "don't know"	80	60	48	44	30
Inaccurate answer	—	12	24	—	10
Good answer	20	40	52	56	70
Points	20	20	—	—	—
"Cellar" or "basement"	—	4	16	20	10
"Dirt"	—	4	4	16	15
What is above the Ceiling?					
No answer or "don't know"	95	40	44	44	40
Inaccurate	—	28	8	12	—
Answers	—	60	56	56	60
Points	—	20	28	—	15
"Light"	—	20	28	—	15
Good answer as "sky," "roof" "attic"	—	—	12	24	45

"Home" is at all ages the predominant answer to "*Where is mummy?*" which is answered correctly by the majority by two years At 2½ years and especially at three years some activity answer as *shopping, working*, etc., is prominent, whereas later some actual place name, as the name of a city, may be given

Where is daddy? is answered adequately by two years, and by nearly as many children at each age as answer the question about mother *At his office*, the predominant answer at three years, gives way by four years to the activity answer *at work* or *working* Some actual place name occurs increasingly, though it has reached only 20 per cent at four years. Answers similar to *at work* but more specific, as "In the lab," or "In class," or "My dad's gone to the hospital" occur in 35 per cent by the age of four years.

The brevity of the answers at 2½ years is noteworthy as is also the *space detail* which spontaneously emerges at three years "He's at his office It's down farther from New Haven. Way down farther—miles away", "In the office Down street Where he goes to the Postoffice to get mail"

Where do fish live? is answered by a majority by 2½ years, *in the water* being the predominant answer at all ages

Where do birds live? is answered correctly by a majority at 2½ years. There is a clearcut trend here from *in the sky,* to *in trees,* to *in nests,* to *in birdhouses*

Where do angleworms live? is more difficult It is not answered correctly by a majority until four years. *In the ground,* or *in the dirt,* is the most common answer.

Where do airplanes fly? is answered adequately at 2½ years and after. The earliest answer is *in the sky* or *in the air,* and this predominates at all ages but gradually the place *to which* they fly, as *to the Airport,* becomes a prominent answer.

Where do the trolleys go? is answered adequately at 2½ years and thereafter *On the street* is the first answer (at 2½ years), later, the answer is more specific, *on tracks.* Destination, i.e., *to such and such a place,* is strong at three years

Where is the roof? is answered correctly at 2½ years and after. *Right up there* (with pointing) predominates at 2½ years *On top* comes next, at 3 and 3½ years, and *on top of the house* at four years Note contrast of the *exact* "right up there" at 2½ and the *expansive* "way up there" at four years. "Up on top of the house" occurs in 15 per cent at four years and "Way up top" or "way up there" occur in 20 per cent at four years

Where is the cellar? is answered adequately at three years, later than "Where is the roof?" *Down* or *down there* (with pointing) is the first answer, some elaboration of a "Down" answer such as "down in the very last floor," "down below the house," "down underneath the house" predominates at every age

Where are chimneys? is answered adequately at 2½ years and thereafter. The exact "right up there" is characteristic of 2½ years, some answer involving *roof* definitely predominates at three years and thereafter Also at three, several (16 per cent) give an associated idea instead of a place answer, i.e., "They have chimneys to keep them warm."

What is under the floor? is not answered till three years. *Cellar* or *basement* is the leading answer at 3 and 3½ years but at four years the answer is, more specifically but perhaps inaccurately, *dirt*. Similarly at four years several (10 per cent) answer *rug*, probably confusing *under* with *on* (an easier concept). Dirt, perhaps, in their minds is *under* the *rug*.

What is above the ceiling? is answered adequately at 2½ years. At this age the child may merely point. At three years he answers *light*, probably confusing *above* with *on*. By 3½ and 4 years he gives a good answer: *sky*, *roof*, *attic*, etc.

b. Questions about Where the child lives. The percentage of children who answer these questions correctly or otherwise is given in Table 6.

Where do you live? is answered by the average child at 2½ years and thereafter. *At home* is the predominant answer at 2 and at 2½ years, *on — street* from three through four years. *In New Haven* (or other city name) is not the predominant answer at any age through four years, but it occurs increasingly with age and over one-third of the children give this response at four years. Both street and city are given spontaneously by 8 per cent at 3 and 3½ years. Both city and state are given by 12 per cent at 3½ years, 15 per cent at four years.

Considering both spontaneous and prompted answers, the street name is given by over half the children at three years and thereafter, the city name at four years. The majority of these children do not name their state, either spontaneously or in answer to questioning, by four years.

Street number is given by very few of these children: 28 per cent at three years, 8 per cent at 3½ years and 15 per cent at four years.

What way do you go to come here from your house? is answered at 2½ years and thereafter by a majority of the children. The first answers are transportation answers, *by car*, etc. At 3 and 3½ years *name of the street* along which the child travels predominates, but also some idea of route or direction is coming in. By four years some detail about direction predominates, with strong use of the word way, i.e., *the goat way, into a new way*.

Examples of the direction answers which are just coming in at three years are: "I have to go left and then right," "This way and then turn left and go up that way." At four years, "We have to go straight ahead and a little hill and then a big hill and see a white house and then that will be our house . . . Just turn right first then left and see that big hill you see and that will be our home."

TABLE 6
Percentage of Children Answering Correctly Questions About Where They Live

	2 yrs	2½ yrs	3 yrs	3½ yrs	4 yrs
Where do you live?					
No answer or "don't know"	**60**	24	4	12	—
Some answer	40	**72**	96	88	100
"At home" or "at my house"	30	24	16	—	—
"On ——" (street name)	5	20	**52**	40	60
"In ——" (city)	—	16	28	32	35
"Near ——," "beside ——," "between ——"	—	—	32	12	30
What Street, City, State do you live in?					
Street					
spontaneous	5	20	52	40	60
	—35	—40	**—60**	—64	—75
otherwise	30	20	8	24	15
City					
spontaneous	—	16	28	32	35
			—44	—46	**—50**
otherwise	—	—	16	24	15
State					
spontaneous	—	4	—	24	15
otherwise	—	—	—	—	—
What way do you go to come here from your house?					
No answer or "don't know"	**95**	48	36	32	15
Answers	5	**52**	64	68	85
Transportation ("by car")	5	16	8	28	20
Name of street	—	4	32	20	20
Direction detail	—	8	24	20	25
Uses "way" in answer	—	—	8	12	25
What streets do you come on?					
No answer or "don't know"	—	**80**	40	80	65
Has already told spont	—	4	36	20	20
		—20	—60		—55
Gives answer	—	16	24	20	35
Names the street	—	8	12	8	5
"Street" occurs in answer	—	4	8	8	30

c Questions about where certain domestic activities take place. Table 7 gives the percentage of children who answer these questions correctly or incorrectly.

Where do you sleep? is one of the few questions which can be answered correctly at two years. *At home* is a conspicuous answer at two years (only), but *in my crib* or *in my bed* is the answer that prevails at all ages, with the more general *in my room* coming in increasingly from 2½ to 3½ years.

Asked further, "Where is your crib?" the child answers at first, *in my house* and later (three years ff.) *in my room. In my bed in my room* is a spontaneous answer at 3½ years. Asked "Where is your room?" answers at first *at home* and gradually (three years and after) gives good space detail

TABLE 7

Percentage of Children Answering Correctly Questions About Where Certain Domestic Activities Take Place

	2 yrs	2½ yrs	3 yrs	3½ yrs	4 yrs
Where do you sleep?					
No answer or "don't know"	35	12	—	16	—
Answers adequately	65	88	100	84	100
"At home"	15	4	4	4	5
"In my crib" (bed)	30	68	60	48	65
"In my room"	15	12	36	36	15
"Upstairs"	—	8	—	12	15
Where is your crib (bed)?					
"In my house"	—	36	20	8	—
"In my room"	—	8	32	20	35
Where is your room?					
"Home"	—	—	20	—	—
Good further detail	—	—	24	8	15
Where does mummy cook your dinner?					
No answer or "don't know"	65	12	—	—	—
Good answer	35	80	100	88	95
"Home"	15	4	4	—	—
"Pan"	5	12	—	—	—
"Stove"	10	24	20	16	5
"Kitchen"	5	32	76	52	40
"Downstairs"	—	—	—	4	15
Where is the stove?					
"Home"	—	16	4	—	—
"In the kitchen"	—	—	8	16	—
Where is the kitchen?					
"Downstairs"	—	4	8	—	—
"Near ——"	—	4	20	—	—
"Beside" or "next to"	—	—	12	8	—
Where do you eat your dinner?					
No answer or "don't know"	65	12	—	12	—
Good answer	35	80	100	88	100
"Home"	15	—	—	—	5
"Chair"	10	12	8	—	—
"Plate"	5	8	—	16	—
"Table"	—	36	24	40	35
"Kitchen"	5	20	56		50
Where do you like to play?					
No answer or "don't know"	60	24	4	12	—
Good answer	40	76	96	88	95
"Home"	15	4	—	8	10
"Outdoors"	15	8	24	12	5
"In the yard"	—	—	8	12	25
"Here" (or "in school")	5	20	16	4	5
"In my room"	5	36	48	28	45
"Upstairs," "downstairs"	—	—	—	8	5

At first *near the bathroom, near daddy's room* and later, more exactly, *next to the bathroom, next to mother's room*

Where does mummy cook your dinner? and *Where is that?* are answered adequately at 2½ years and thereafter The first answer, at two years, is the general *at home* At 2½ years the outstanding answer is *on the stove*, and at three and thereafter the answer is *in the kitchen* At four years some answer *In the kitchen on the stove.*

When asked, *Where is the stove?* the answer at 2½ years is *at home*, at 3½ years, *in the kitchen* When asked *Where is the kitchen*, the answer is at three years *near* ————, and at 3½ years, *next to* ————

Where do you eat your dinner is answered adequately by 2½ years. The first answer, at two years, is *at home*. By 2½ years the answer is *on the table* At three and four years the answer is *in the kitchen*, and at four years some say *on the table in the kitchen*

This is an exactly parallel trend to the answers to "Where does mummy cook your dinner?"

Where do you like to play? is answered adequately by 2½ years The trend in answering is from *home* or *outdoors*, at two years, to *in my room*, which predominates at all ages thereafter *In the yard* increases steadily, being the second most common answer at four years. Thus the trends are from the more general—*home, outdoors*—to the more specific aspects of these two places, *in my room* and *in the yard*.

d Questions about the route to and location of places to which the child goes on certain occasions This includes the following questions, plus some follow-up questions, as per Table 1, in case the child does not give full details spontaneously

Where do you go for your vacation? (2½ years)
Where do you go on Sunday? (2½ years)
Do you go to visit your grandmother, and
    Where does she live? (3 years)

Table 8 gives the percentage of children who answer these questions correctly or otherwise.

Where do you go for your vacation? is answered adequately by 2½ years. *To the beach* is the outstanding answer at 2½ and 3 years The response then becomes more specific with "To ————" (some place name) predominating at 3½ and 4 years What detail the child can give is usually given spontaneously The question "Where is that?" does not appear to clear things up much

TABLE 8

PERCENTAGE OF CHILDREN ANSWERING CORRECTLY QUESTIONS DEALING WITH ROUTE AND LOCATION OF PLACES VISITED

	2 yrs	2½ yrs	3 yrs	3½ yrs	4 yrs
Where do you go in the summer?					
No answer or "don't know"	90	44	28	32	30
Good answer	10	52	72	68	70
"To the beach"	—	28	32	8	25
"To ——" (place name)	—	12	16	28	24
"On the train," etc	—	12	—	—	—
"To ——" (someone's)	—	—	12	20	10
Where is that?					
"In ——" (place name), or "Down at ——"	—	20	16	16	12
"Far away"	—	—	4	8	10
How do you get there?					
No answer or "don't know"	100	52	40	44	45
Good answer	—	48	60	56	55
Vehicle answer "By car" etc	—	32	40	40	35
A direction answer	—	—	20	16	15
Activity answer "You drive"	—	—	—	4	10
What way do you go to get there?					
A direction answer	—	—	36	20	15
What do you go by?					
Some answer	—	16	20	32	30
"On the train," "in the car"	—	16	4	—	10
"By ——" (street)	—	—	16	—	—
Names objects gone by	—	—	—	32	20
Where do you go on Sunday?					
No answer or "don't know"	100	48	32	20	15
Good answer	—	52	68	80	85
"Sunday school" or "church"	—	8	16	12	20
"To ——" (some person's)	—	8	8	20	—
"To ——" (some place name)	—	—	12	20	25
What way do you go to get there?					
No answer or "don't know"	100	80	60	72	—
Good answer	—	20	40	28	15
Direction or place answer	—	16	20	8	—
Mode of transportation	—	—	20	12	15
What streets do you go on?					
Answers adequately	—	12	20	16	—
Do you go to visit your grandmother?					
No answer or "don't know"	70	24	—	—	—
Answers affirmatively	30	56	88	68	70
Where does she live?					
No answer or "don't know"	80	60	36	60	65
Some answer	20	40	64	40	36
"House"	5	4	4	4	—
A city name	5	8	16	36	10
A street name	—	12	28	—	10
How do you get there?					
Answers	—	28	—	20	20
Transportation answer	—	20	—	20	20

The further question, "How do you get there?" is answered adequately at three years and after, though 48 per cent answer as early as 2½ years. At that age a *vehicle* answer is customarily given, i e , *in the car,* or *by car.* Vehicle answers continue to predominate but *direction* answers come in to some extent at three years and thereafter, that is, *along such and such a street,* etc The question is pursued further as "What way do you go to get there?" and "What do you go by?" These are not answered by very many of the children, but the following sequence is suggested

1 "By train" or "by car"—2½ years ff
2 "Along such and such a street"—3 years ff
3 Object passed by (cars, houses)—3½, 4 years
4. Actual direction, i.e., "turn left"—3½ years ff
5 "The goat way," "the ball place," "the school street"—4 years especially

Where do you go on Sunday? What way do you go to get there? What streets do you go on? What do you go by? are answered more or less adequately at 2½ years and thereafter. At 2½ years, however, there is almost complete variety in the answers At three years, *Sunday School* or *church* is the outstanding answer, at 3½ it is either *To* ——— (some person's) or *To* ——— (some place). At four, *To* ——— (some place) definitely predominates The early answer of *Sunday School* is perhaps like the early answer *home,* just an almost automatic answer probably involving very little notion of space

Further questions on this topic are not very productive except that "What do you go by?" is at first (2½ years) answered by a *vehicle* answer, i.e , *by car, by train,* and later (three years ff) by the names of objects actually passed en route

Do you go to visit your Grandmother? Where does she live? How do you get there? are answered adequately at 2½ years and thereafter. At three years and after children can tell where grandmothers live The first answers are *in her house,* later the answer is a street or city name (perhaps depending on whether or not grandmother lives in the same city as the child) "How do you get there?" is answered in nearly all cases by a transportation rather than a direction answer.

C. Discussion

1. *Levels in Attaining Concepts of Space*

As with concepts of time (1), complete mastery of any one space concept is not acquired all at once There are several different levels of attainment As a rule the child is first able to respond to a space word, then he uses it spontaneously and finally uses it in answer to questions Thus the child responds to the word "on" at 18 months by putting the ball "on the table" At 21 months the average child (in our group of subjects) uses the word spontaneously, and at two years uses it in answer to questions

A further sequence of responses to space is observed in that the child may first, when confronted with a space concept by the adult, merely look at the object or in the direction suggested *Looking*, with no further response, is prominent from 18 months to two years *Pointing* (usually accompanied by looking) begins at 21 months and is extremely conspicuous at 2½ and 3 years, not occurring conspicuously thereafter *Verbalization* gradually takes the place of looking and pointing. By 3½ years there is little pointing, especially in answer to questions.

Furthermore, whether we consider the words a child responds to or the words he uses himself, we find that many space words, especially prepositions, can be understood first in connection with object words and later when used alone. (This in spite of the fact that the child's first verbalizations at 18 months may be the one-syllable "up," "down")

On the table, in the box, under the bed are used and understood before the more abstract *on, in, under* Also *on top, on there,* etc, are used by the child as a rule before *on* alone

An analysis of the use of *in, on, up* and *out* by the present subjects in answering space questions yields the following information.

In the house or *in* ——— (some object) predominates almost exclusively through the first four years, though there is a little use of such phrases as *in there. In* alone is seldom used

On ——— (some object) at first predominates but after three years *on top, on there,* or some similar phrase occurs about one-third as much as the other. *On* alone is just beginning to appear at four years

Up in ——— (some object) or *up on* ——— (some object) predominate at all ages but *up here, up there,* or some similar phrase is strong at all ages after two years.

In the case of *out,* this word is first used (after the very early one-word-sentence use of *out* alone) in combinations such as *outside,* or *out there* At and after 3½ years, *out in* ——— or *out on* ——— predominate

2 *Use of the General Preceding Use of the Specific*

In a study of the development of concepts of time (1), it appeared that the child used specific time expressions such as *wintertime, lunchtime,* before he could use the more general or abstract word *time*, or *today* before *every day* or *in a few days*.

The situation in regard to space words is a little more complex. The very first words used (in answering space questions) are somewhat general, then comes a period of very specific answers, and then again answers become a little more general. Thus in answer to "Where do you sleep?" the child says at first *home* or *at home*. Later he answers, *in my crib* or *in my bed* and still later, *in my room*.

Similarly in answer to "Where does mummy cook your dinner?" the child answers at first, *at home*. Later he says, *in a pan* or *on the stove*, but still later he says, *in the kitchen*. Other similar sequences can also be noted. In answer to "Where do trolleys go?" the earliest answers (2½ years) are general: *on the street*. Later the answer is more specific, *on tracks*. Similarly birds are first said to live *in trees;* later *in nests*.

Though each particular concept has its own time schedule, as a rule the first general answers are given around two years, becoming more specific and limited at 2½ years (i.e., pan, stove, crib, etc.) and again becoming more general at three years of age.

A further interesting trend occurs in answers to the question, "How do you come (go)?" or "What way do you go?" The first answers are in nearly all cases *vehicle* or *transportation* answers, i.e., *by train, by car*. This is predominant at 2½ years. The next stage appears to be a *street* answer, *Along such and such a street* occurring in many at three years and after. The object passed by, i.e., *by houses, by cars and trucks*, comes next; in many at about 3½ years. In others at this age the actual *direction* is given, i.e., *you turn left and then right*. A few, at four years especially, have their own names for routes, i.e., *the goat way*, or *by the ball place*.

A very similar trend is seen in the answers to "Where do airplanes fly?" The first answer and the predominant one at all ages is *in the sky*, i.e., the *place where* they fly, but the *destination* to which they fly, i.e., *to the airport* is conspicuous at 3½ years especially.

It further appears that concepts involving *up* or *aboveness* precede, in any one child, the opposite concepts of *down* or *belowness*. The following examples illustrate this. *Up* and *down* both come in at 18 months, but *up* is used first by any individual child. *Upstairs* comes in at two years, *downstairs* at 2½. The child can tell that birds live *in the air* at 2½ years, but cannot tell that angleworms live *in the ground* until four years of age. He knows that the roof is *on top*, or *right up there* at 2½, but cannot tell that the cellar is *down there* until he is three years old. "What is above the ceiling?" is answered at 2½ years, "What is under the floor?" not till three

The earliest space words appear to be one-dimensional *up, down, on, off,* used at 18-21 months The slightly more complex notion of container and contained comes in at two years with the words *in* and *out* *Other side,* at two years, suggests a further dimension of space, and *there* and *where* expand the space-world expressed by the 18-month *here*

Between 2 and 2½ years the largest number of new space words is added, expressing not so much an increased complexity of space as an increased interest in exactness of location, *right here, right there.* A beginning interest in more distant places is expressed by *far* and *far away.*

A definite refinement in space concepts is expressed at three years in such words as *over, back, corner, from, by.* A marked and new interest in space direction and detail comes in. *To* used with a city name shows increasing expansion of space interest

Under and *between* are new dimensions coming in at 3½ years *Go* (meaning belong) and *find* show interest in appropriate places for objects. Interest in comparative sizes is verbalized. Expanding but exact interest in location is indicated at this age and at four years by conspicuous use of *way down, way off, way far*

3. *Individual Differences*

As in the case of concepts of time (1), there are marked individual differences in regard to concepts of space. Many children achieve an early and apparently adequate orientation in space To others, such orientation comes late and is much less adequate.

Such differences are illustrated in Table 9 which gives contrasting examples of poor and good space orientation at two years in children who rate "superior" on the developmental examination.

D DEVELOPMENTAL SUMMARY

Despite individual differences just noted, there is a relatively uniform age sequence in the development of the major concepts of space. This sequence tends to hold from child to child and also for the individual child. Table 10 summarizes the age sequences typical for the group of preschool children reported in the present study. This study concerns the verbalization of space concepts and orientations. It touches only lightly on the personality factors which inflect the maturity trends.

TABLE 9

Individual Differences in Understanding of Space Concepts

24-month level					
Child *C K* No correct = 4			Child *S P* No correct = 12		
1	Where is mummy?	She's gone now	1	Where is mummy?	In the car
	Where is daddy?	Him away		Where is daddy?	Going to office
8	Where do you sleep?	Bed bilo	2	Where do you live?	Almroch Lane
	Where is that?	Upstairs	4	Where do fish live?	In the water
9	Where cook dinner?	Upstairs	5	Where do airplanes fly?	In the air
				Where do trolleys go?	On twacks Dey blong on twain twacks
			6	Where is the roof?	(Looks) Up ere a light
				Where is the cellar?	(Points down)
			7	Where are chimneys?	(Looks)
			8	Where do you sleep?	In my bed Upstairs
			9	Cook dinner?	In a pan
			10.	Eat dinner?	In a plate
			11	Like to play?	Outdoors

TABLE 10

AGE TRENDS IN THE DEVELOPMENT OF SPACE CONCEPTS

1 year

Gestures for *up*
Wriggles for *down*

18 months

Spontaneously uses *up, down* and *off*, dealing chiefly with his own basic movements in space. *Come, go* and *gone* also refer to his own activities or the presence or absence of objects in which he is directly interested.

No space words commonly used in answer to questions. Child may merely look in a direction indicated. He can, in examination, obey two directions with ball, putting it on chair and giving it to mother.

21 months

Still no space words in answer to questions, but *up, down, on* and *off* are all used spontaneously, also the size-word, *big*. Also, most characteristic of this age are *all gone*, expressing interest in absence or departure of an object, and *here*, suggesting the "here and nowness" of this age. Child frequently merely looks in a direction indicated.

24 months

Uses space words both spontaneously and in answer to questions. Although 2 years is not a particularly expansive age, note the expansion from earlier "here and nowness" implied in the use of such words as *there, where, other side, outdoors, up stairs, up high*.

The more complex notion of container and contained comes in with *in* and *out*. *In* is used more than any other word in answer to space questions. *All gone* is still strong. There is great interest in having things in their proper places.

The child can answer such space questions as "Where is Mummy?", "Where is Daddy?", "Where do you sleep?" He can obey four directions with ball putting it on chair, on table, and giving it to mother and to examiner.

30 months

At this age the use of space words is very much in keeping with the rigid, patterned, exact behavior of the age. Many of the space words are rigid, exact words and many appear at this age only. Thus we have, *right, right here, right there, right up there, right home, right down, right in*.

Also note at this age for nearly the first time two space words combined to give more exactness to the location indicated: *way up, up in, in here, in there*, in addition to those listed above. *Near* represents a definite advance over the earlier *in* or *at*. A beginning interest in more distant places is expressed by *far* and *far away*.

Further, the most new space words are added in the 6-month period from 2 to 2½ years of any 6-month period under consideration, both in spontaneous verbalization and in answer to space questions. (In contrast to the addition of the most new "time" words between 2½ and 3 years.)

Also, of questions asked in this investigation, the largest number of questions becomes answerable in this 6 month period of any other period studied. (See Table 5, p. 69.) Such questions deal chiefly with customary location of common objects or activities.

Words used most are *in, on, up in* and *at*. There is great interest in and marked insistance upon having objects in their proper places.

TABLE 10 (*continued*)

36 months

Most of the space words used at 2½ years are continued in use except for a few of the more exact and rigid words, such as *right there, right up there,* etc A few of the new words which come in, though not as exact as the 2½ words, express an increased refinement in space perception' *back, corner, over, from, by, up on top, on top of*

A new and marked interest in space detail and direction detail comes in at this age, particularly in answering questions In telling how to get somewhere the child may give an actual direction, i e, *turn left and then turn right* In telling where his Daddy is he no longer says merely, "At his office" but spontaneously describes where the office is In telling where he sleeps he may tell where his crib, or bedroom, is located *To,* with a city name, shows increasing expansion of space interest

The 3-year-old can tell what street he lives on though usually not the number He can put a ball *on* and *under* a chair New questions answered at this age deal chiefly with where people live and how to get to certain places.

In, on, at and *to* are the words used most

42 months

Next to, under and *between* all mark increased interest in new dimensions of space, *Go* (meaning belong) and *find* (or found) express interest in appropriate places for objects Interest in comparative size is indicated by *littlest, bigger, larger Way down, way off, way far* express expanding but also exact interest in location

In answering questions, the 3½-year-old uses actually less different words than the 3-year-old, in spontaneous vocalization, a few more He can now put the ball *on, under* and *in back of* a chair *In, on, to, home* and *up in* are words used most

*48 months**

The space verbalization of the child of this age includes most of the words used before plus a few new ones Outstanding at this age is the use of expansive space words characteristic of the out-of-bounds expansive tendencies of the 4-year-old Some of these words have been used before but are especially noteworthy as a group at this age Thus *on top of, far away, out in, down to, way up, way up there, way far, out, way off* A new dimension is suggested in use of the word *behind*.

The child can now tell both on what street and in what city he lives He can put a ball *on, under, in front of* and *in back of* a chair

In, on, up in, at, and *down* are space words used most

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*For ages above 4 years, see pages 441-443 in Gesell and Ilg *The Child from Five to Ten*

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THE RELATIONS OF OLDER CHILDREN TO THEIR PARENTS*

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A THE PROBLEM

The problem of parent-child relationship is actual both from practical and scientifical points of view It is surely due to the merit of Freudian psychoanalysis (4) that this problem plays a considerable rôle in psychological and psychopathological theories. The increasing and deepening inquiries of social and genetic psychology, however, are other reasons why the problem of parent-child relationship is becoming the object of inquiries carried out on an empirical basis

The importance of this problem is obvious, especially with regard to the social development of the child Parents are, in our social organization, the unique representatives of society to the child, at least during his early period of life. Although the child comes into contact also with other adult persons in the further course of his development (with his relatives, with neighbors, later on with teachers, with employers, with officials etc), he remains for a long period, more or less, in strong contact with his parents, and in some cases even throughout his life time The facts that the child and his parents are related and more so that the child is living with his parents in one family are of decisive importance The family, as it is commonly agreed upon (1, 7), is the most effective part of social environment. The family is the first real social group and social institution which the child lives in. It exerts its influence on the child before the other parts of the social environment have possibilities to interfere It moulds him during the most plastic periods of his life and continues to do so for a considerably long time

The child-parent relationship is, thus, a very serious factor in the personality development of the child His mental makeup is formed by means of it and the child usually gains from it the basis for his social attitudes that are characteristic of his personality "Whatever the amount of general truth there may be in the Freudian theories of these complexes"—says J S Ross—"it is at least certain that the early attitudes of the young child toward his

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parents, brothers, and sisters are of abiding importance, and that throughout life they tend to color his emotional relations with other people" (8, p. 143). Furthermore, this relationship is one of the most fundamental contacts in man's social interaction because it is rooted in the family, which is, according to Cooley (3), one of the three basic primary social groups.

In the present study, an attempt has been made to throw light on the problem regarding the following detailed questions. What is the child-parent *relationship* with older children? How do these relationships differ between boys and girls? How do these relationships differ with regard to father and mother?

B. Method and Material

We shall try to answer the above given questions by means of a questionnaire. Our study is based on *Questionnaire O VIII* used in the Psychotechnical Institute at Bratislava (Czechoslovakia). The relative questions posed in it are: *What is your father's relation to you, and yours to him?* (Write down in detail), *What is your mother's relation to you, and yours to her?* Sufficient space is provided for the answers, and no limitations are made as to length or mode.

The questionnaire was a part of a psychological examination undertaken prior to consultation regarding choice of future careers. The subjects questioned were students of the VIIIth class of gymnasium (the highest class in the secondary school of our country which the students finish by examination of maturity). The present study is based on answers given by 775 students of 18-19 years of age, of which 575 were boys and 200 girls. They come from 17 different districts of Slovakia. The examinations were made during the period 1934 till 1942. The selection of students was completely a matter of chance, as only those who applied for advice on vocational guidance were examined.

It is worthy to stress the fact that our material was not collected with research aims. The questionnaire applied in our study was part of a battery of tests used for diagnosis of abilities and personal attitudes of those applying for advice in choosing a career. We consider this circumstance of importance because, according to our experiences, the applicants of this age took the examinations very earnestly and answered the questions with utmost sincerity.

C The Results

1 *Classification of Answers*

The first and most difficult task was to evaluate the given answers As mentioned above, the answers to the given questions were original and without limitations The extension and the form of answers were not predetermined by the questionnaire itself Thus, we obtained fine and sometimes touching descriptions of students' relations to their parents but neither the classification nor the evaluation of their relationship

We were obliged to classify the answers ourselves with regard to different qualities of relationship depicted in them Principally, we tried to classify the given answers into three classes good, neutral, and bad In the course of work, however, and after various efforts it became necessary to alter this into four classes of student-parent relationship, as follows

a Intimate and friendly. Into this group were placed relations to father and mother described as good or the best, also those that stated there existed an intimacy or mutual understanding between questioned and parent This degree of relationship was often spoken of as a true friendship, a warm and hearty sincerity existing between them. Some quotations from the material may serve as illustrations

Daughter to father

> My father gained my respect by his perfect and really model mode of life. He is not very severe, but in his decisions he is firm and unalterable Our relationship is sincerely friendly, a better one cannot be between daughter and father.

Son to mother

> A simple, good hearted, fine woman and mother She is very sympathetic towards other people When I am sad she is sad even more than I. She fully understands what I need She kindly satisfies my wishes, she is sincere I have the best relation to her, and she has the same to me.

b Good We classified as a good relation such descriptions that mentioned only good moments There were neither objections nor such circumstances which would make the relation worse But there was a lack of friendliness and sincerity, otherwise such descriptions could have been included in the first class

Son to father

> My relation to my father is good It is however, not friendly in the true sense of the word (because I say to him "you") (instead of "thou"

> as is the custom in our *families of higher social status—remark of the author*) I see in him a superior person Otherwise the relationship is good

Son to father.

> My father is towards me quite good, our relationship, however, lacks sincerity But on the whole, we get along together well enough

c Reserved. We denoted by this term a middle or transitory class between a good and bad relationship This degree of relationship was often described as being "quite good," but they expressed some objections against the parent which suggested that the relationship in reality was not quite good, that something was lacking in it This class means, therefore, a transitory form of relationship between a good one and a bad one, or, in certain respects at least, a neutral, neither good nor expressively bad attitude of the youth towards his parent. There were always expressed some reserves, some objections, but in spite of that the relationship of this group cannot be considered as completely negative

Son to father:

> Since I started at the secondary school he behaves towards me respectfully and kindly. He is proud of me and he wishes that I too shall be "proud." He inserts in me his greatest hopes because he has been badly prosecuted by his destiny. I do respect and love him as a son—more under the influence of the school and moral than instinctively—, I feel, however, always shy towards him and I have always some reserve in my sincerity, even more so an uncontrollable hidden fear towards him—having its source in my father's severity, even cruelty towards me during my childhood

Son to mother.

> It is sure, she loves me immensely, especially now when she has nobody else. Her love, however, manifests itself by rather unagreeable modes—either fondling or sometimes as unappropriate and superfluous anxiety about myself. We like each other, without doubt, but we do not understand each other as I did my father

d Cool and strained. We placed in this fourth class the clearly bad or negative descriptions of relationships between children and their parents The relationship of this type usually was indicated by coolness, lack of mutual understanding, lack of love, even more displayed overt hatred and strained relations They usually added also the details depicting the causes and forms of this negative type of child-parent relationship

Son to mother:

> On my relation to mother I have to say quite the opposite than on those to my father She does not understand me and I do not understand her, the quarrels between us are frequent and often I nearly hate her

Daughter to mother.

> My mother is severe not only towards me but also towards my brothers and sisters But I feel the burden of her severity the most of all My mother is an aching place in my soul Although I should have become accustomed to her I find that her bad words still hurt me and even more so her good words which are, however, very rare. Our relationship, accordingly, is very cool I do not trust her altogether because what I tell her in confidence she uses to hurt me in the next instant

The first two classes of our classification were decidedly positive, whereas the fourth class was clearly negative There were some difficulties only in regard to the third class, called "reserved." The relationship this class expressed, was neither expressively good or bad There were details expressing relatively good relations to parents, but there were always some reserves which were almost regularly introduced by the word "but" or "however" Consequently we considered this class of "reserve" as a transitory type between the good and bad relationship

In order to get completeness in statistical elaboration we were obliged to differentiate two further classes of relationship, i e , V. Answer Omitted, and VI. No Father or No Mother

2 *Frequency of Qualitative Degrees of Child-Parent Relationship*

Having worked out the classification of answers we may now proceed to give an answer to the first question posed: *What is the relation of the older children towards their parents?*—We can do that by counting the frequency of different qualitative classes of relationship, as obtained by our work described previously.

The results of this are shown in Table 1 In the first column are indicated the different classes of relationship, in the second are given the results related to the father, and in the third those related to the mother, in each case separately for boys and girls The relative numbers computed in percentage are added below each frequency.

Let us look first at the figures in the column representing the relations of sons and daughters to their fathers The relationships of the first quality (intimate and friendly) were found in 68 cases of the boys' answers, i e ,

TABLE 1

RELATIONS OF OLDER CHILDREN TO THEIR PARENTS

Classes of relationships	To father		To mother	
	Boys	Girls	Boys	Girls
Intimate	68	35	120	64
Friendly	11 8	17 5	20 9	32 0
	151	58	196	50
Good	26 3	29 0	34 1	25 0
	131	44	122	41
Reserved	22 8	22 0	21.2	20 5
Cool and	93	24	50	22
strained	16 2	12 0	8 7	11 0
Answer	55	16	65	14
omitted	9 5	8 0	11 3	7 0
No father	77	23	22	9
No mother	13 4	11 5	3 8	4 5
Total	575	200	575	200
	100	100	100	200

11 8 per cent, 35 cases of the girls' answers, i e , 17.5 per cent The relationship of the second degree (good) occurred in 151 cases of boys, 26 3 per cent, 58 cases of girls, 29 0 per cent Figures in further columns may be read accordingly.

The first conclusion drawn was the frequency of the two positive classes of child-parent relationship The positive relation of older children to their parents was most frequent, boys 38 1 per cent and girls 46 5 per cent

The reserved relationship was found in answers of boys and girls in equal quantity, i.e., in 22 8 and 22 0 per cent respectively.

The negative degree of relationship (cool and strained) occurred in the case of boys 16 2 per cent and of girls 12 0 per cent

The rest fell into the class of "answers omitted" or "no father," "no mother "

The results relative to mother-child relationship were more favorable The intimate and friendly relation towards the mother totaled with boys 20 9 per cent, with girls 32 0 per cent The good relationship, with boys 34 1 per cent, with girls 25 0 per cent

The first two classes, considered as positive relationships, taken together give the results· for boys 55 per cent, for girls 57 per cent These results were, thus, considerably better than those for child-father relationship

While the results for reserved relationship were nearly the same for both parents, they were markedly lower for the negative relationship in the case of the mother.

We noted, accordingly, that in about one-third to one-half of the cases the youths had decidedly positive relationship with their parents, approximately one-fifth of the relationships were reserved, of unclear or transitory quality, whereas in one-sixth to one-tenth the relationships revealed were decidedly negative.

3 *Sex Differences in Child-Parent Relationship*

The first glance at the figures in Table 1 proves that there are remarkable differences between the frequency of boys and girls, and also between the results relating to fathers and mothers. It is, therefore, necessary to study the question more fully.

In order to make clear the differences between boys and girls we present the data of Table 1 graphically in Figure 1. The first part of it shows

Relations of Older Children to Their Parents

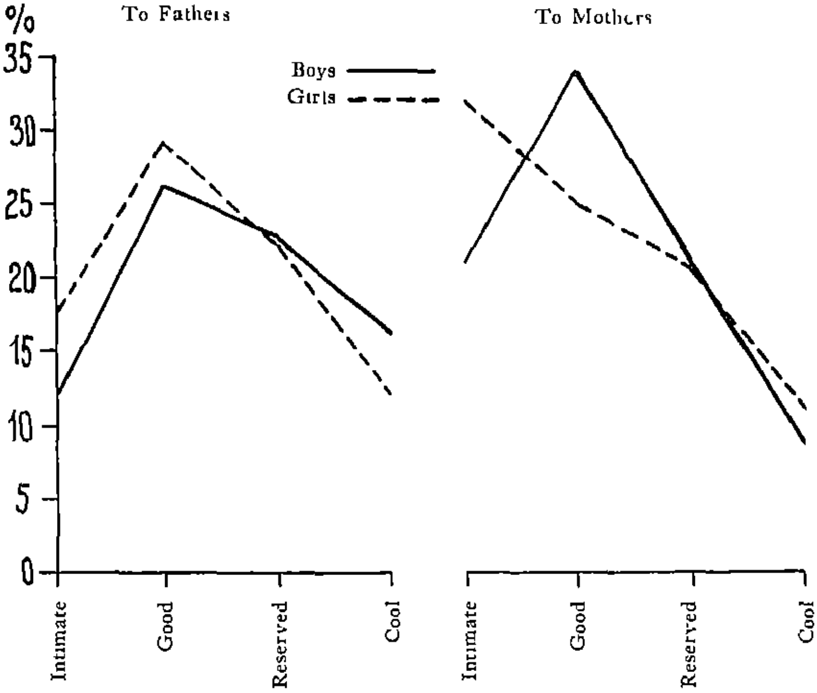

FIGURE 1

the relation of boys (solid line) and girls (broken line) to their fathers (the first two columns of numbers in the table), similarly, the second part represents the relations to mothers Only the relative numbers are graphically elaborated (given in percentage)

The first glimpse reveals a considerable difference between boys and girls The greatest difference is in the father relationship. The intimate-friendly and good relation to the father occurs more frequently in the case of girls than boys, whereas the bad relation occurs more often with boys than with girls

The same, though in somewhat lesser degree, is true of the relationship to the mother (the second part of Figure 1). The girls clearly are more often intimate and friendly with their mothers than boys. The boys, however, tend to have a "good" relation to their mothers more often than the girls. Regarding the bad and cool relation to the mother, a reverse result to that of the father is found. The proportion of girls is, in this respect, a little higher than that of boys.

In order to inquire further into the sex differences, we should study such differences by regarding relations to both parents of boys and girls respectively If we add the numbers for boys and girls without differentiating father and mother, we obtain the results given in Table 2.

TABLE 2
THE RELATIONS TO BOTH PARENTS

	Intimate friendly	Good	Reserved	Cool strained
Of boys	16 3	30.2	22 0	12 4
Of girls	24 8	27 0	21 3	11 5

These numbers are graphically shown in Figure 2, where again the solid line represents boys, broken line girls

It is clear from the above that the relations of girls to their parents are generally better than that of the boys The girls tend to be more often in intimate and friendly relation with both parents and less often in reserved and bad, although the difference in the latter is less distinct.

We may undertake a similar proceeding as regards the relation of children, boys and girls collectively, to their parents, respectively. The data taken from Table 1 separately for fathers and mothers (neglecting distinction between boys and girls) are indicated in Table 3

The numbers are again drawn graphically in Figure 3, where the solid

The Relation of Boys and Girls to Both Parents

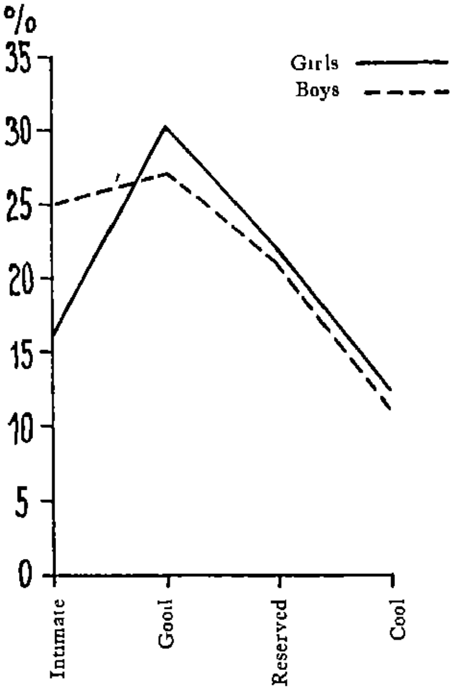

FIGURE 2

TABLE 3
The Relations of Children

	Intimate friendly	Good	Reserved	Cool strained
To fathers	13.3	27.0	22.6	15.1
To mothers	23.7	31.7	21.0	9.3

line represents the relation of children (disregarding their sex) to fathers, and broken line to mothers.

The differences are here more than obvious. The relation of children to their mothers is much more often intimate and good, rarely reserved, and even more rarely bad than the relation to fathers.

4 *Discussion*

From our data is apparent the degree in which youths of 18-19 years of age have adapted themselves to their parents. In this developmental period

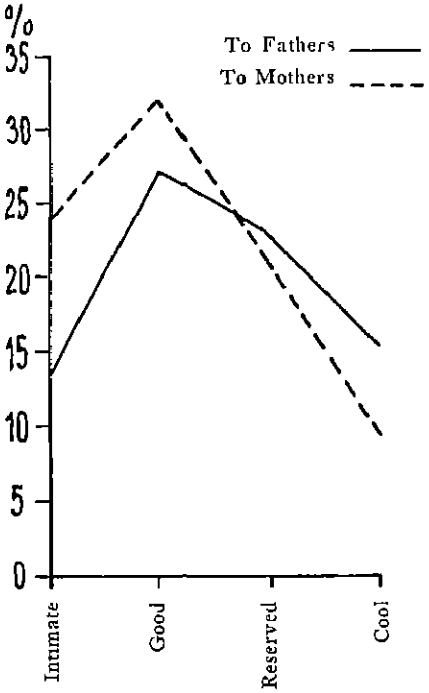
THE RELATIONS OF CHILDREN TO FATHERS AND MOTHERS

FIGURE 3

of attaining maturity, only 8-16 per cent of the children have failed in building an appropriate attitude towards their parents, whereas the greater part of them have succeeded in this task.

Our material does not allow comparisons either with earlier or with posterior stages of social development. But if we grant some value to the common assumptions as regards the difficulties in social adjustment during the period of puberty and early adolesence, as they are referred to in works on this matter (2, 6, 9, 15) we can conclude that the youths and maidens of 18-19 years have already reached a fairly high degree in their process of social adaptation, at least as regards building a sound attitude towards their parents, and that the girls are in this respect higher than boys.

Our results throw also a peculiar light on Freudian theory of the so called Œdipus complex. They seem to provide some evidence regarding father-child relationship. It is proved that sons, unlike daughters, seldom tend to be in good or intimate, but more often in bad relation with their father The evidence is, however, lessened as regards to the relations towards the mother Here again the sons tend to rate below the daughters in good relations. The rule is, further, maintained in the bad relation, where the boys rate below the girls It is worthy to note that the sons show more "good" relations with their mothers, whereas the daughters tend to rate higher in intimate and friendly relations.

According to our belief, the Œdipus complex does not seem to be an effective factor in these relations as the data obtained show that the daughters hold a special position generally They are more sociable towards their fathers as well as towards their mothers than the sons There is just one exception to this rule, and that is in the bad relation towards the mother The differences are, however, slight

Considering the data represented in Figure 3, it becomes clear that the mother is much closer to the children than the father in every respect We may clarify this circumstance in different ways Firstly, it reflects the fact that the mother spends much more time with her children than the father She has, thus, more opportunity to know them better, to be closer to them, to become intimate and friendly with them Secondly, the personal attitudes of fathers and mothers towards their children are certainly different The mothers devote, even sacrifice themselves much more for their children than the fathers The mothers have, thus, more patience, more understanding than the fathers. And, lastly, comes in consideration the rôle played by the father and mother in the family as a social institution The father has to work generally outside the family, being employed in works that have nothing in common with the intimate contents of family life except the earning of money for maintenance of the family The mother, on the other hand, dwells at home most of the day She is engaged mainly in tasks that are in closest touch with the vital interests of each member of the family, and so she becomes a link in the family life to which everybody is closely attached Therefore, she has the opportunity of becoming more intimate, friendly, and good to each child in her family than the father

D RELATIONS TOWARDS FATHERS AND MOTHERS COMPARED

We have proceeded further to resolve one more question Is there any relationship between relations of children toward their fathers and toward their mothers? We have tried to throw some light on the question, having the intention to elucidate whether the child forms his relations towards both parents equally, or in different ways If we put the question in another way,

TABLE 4

RELATIONS OF OLDER CHILDREN TO THEIR FATHERS AND MOTHERS

Relations to mothers	Relations to fathers: Intimate friendly Boys	Intimate friendly Girls	Good Boys	Good Girls	Reserved Boys	Reserved Girls	Cool strained Boys	Cool strained Girls	Total Boys	Total Girls
Intimate	**31**	**18**	38	17	16	13	19	5	104	53
Friendly	**29.8**	**34.0**	36.5	32.1	15.4	24.5	18.3	9.4	100	100
	19	5	**67**	**23**	50	10	37	6	173	44
Good	11.0	11.4	**38.7**	**52.3**	28.9	22.7	21.4	13.6	100	100
	12	8	24	8	**45**	**16**	15	5	96	37
Reserved	12.5	21.6	25.0	21.6	**46.9**	**43.3**	15.6	13.5	100	100
Cool	4	4	13	5	10	10	**15**	**2**	42	21
Strained	9.5	19.0	31.0	23.8	23.8	47.6	**35.7**	**9.6**	100	100
Total	66	35	142	53	121	49	86	18	415	155

we may ask, whether the child proceeds in building his relations towards his parents by correlation or by compensation.

We tried to answer the question by comparing the data revealed with regard to the relationship to father and mother Table 4, constructed as a dichotomic table, shows the results of this work The rows in it indicate classes of relations towards mothers, the columns those towards fathers. Boys and girls are taken separately. To each frequency are added relative numbers in percentage We used for this purpose only the cases in which the relations to both parents were given.

Regarding the table by rows we can follow that from 104 cases of boys having intimate relations to their mothers 31 have also intimate relations to their fathers, this makes 29.8 per cent; 38 boys have good relations (36 5 per cent); 16 have reserved relations (15 4 per cent), and 19 of them have cool and strained relations to their fathers (18.3 per cent) In the same way is analyzed the good, reserved, and cool relation to mother and father in second, third, and fourth row respectively The figures for boys and girls are given separately.

If the child-parent relations are formed by the principle of correlation we should expect rather high coincidences of equal classes of relationship. The figures in heavy types, however, indicate that this is not the case The coincidence is just in one instance over 50 per cent, varying from 9 6 to 52 3 per cent. The coefficients of contingency, computed from these figures, are for boys $C = 305$, and for girls $C = .321$ There is, thus, only a slight tendency to correlation between child-father and child-mother relationship

For the sake of better insight into these facts, we have drawn the figures, given on Table 4, graphically in Figure 4 In the first part of it is represented only the analysis of the intimate relations of boys and girls to their mothers, and these are divided into different degrees of relations towards their fathers (the numbers of the first row in the table). The second part of diagram shows the same for the good relations to mothers (second row of the table), the third part the same for reserved, and the fourth part for cool relationship (the third and fourth row in the Table 4)

On looking at the first part of Figure 4 we see that only 29.8 per cent boys and 34 per cent girls have an intimate relation both to their mothers as well as to their fathers. Of those who have intimate relations to their mothers 36.5 per cent boys and 32.1 per cent girls fall into the "good" relation to their fathers, 15 4 per cent boys and 24 5 per cent girls into the "reserved", and 18 3 per cent boys and 9.4 per cent girls into the "cool

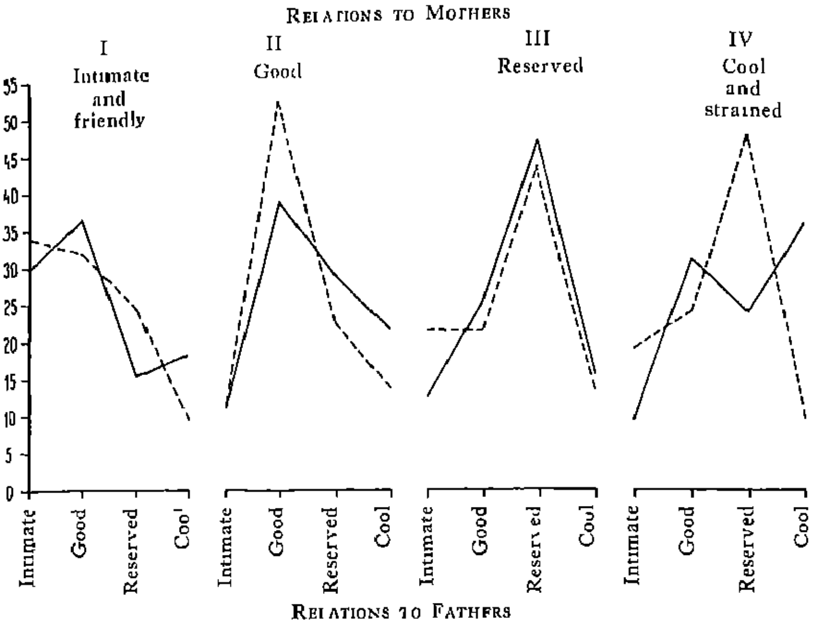

FIGURE 4

and strained." According to this we may conclude that an intimate relation of children to both parents is rather seldom, occurring in no more than one-third of the cases, the remaining two-thirds show that, although they are in intimate relations with mothers, they have a lower class relationship towards their fathers. The boys show a greater tendency to increase the rule than the girls.

The analysis of data in good and reserved relationships (second and third part of Figure 4) show the same tendency, though in somewhat lesser degree. The coincidence of equal classes of relations towards mother and father is there greater (40-50 per cent), but in spite of this, over one-half of the cases show better, or worse, relations towards their fathers than towards their mothers.

The tendency stated above is strongly proved by analysis of cool and strained relations of children towards mothers (part fourth of Figure 4). There are 35.7 per cent of boys and only 9.6 per cent of girls who have a cool relation towards both parents. The rest of them, 64.3 per cent boys and 90.4 per cent girls, though relations to their mothers are bad, have at least a reserved or even good and intimate relations to fathers. The picture remains the same when we take as the base the relations to 'fathers and analyze their frequency regarding the mothers

We may, therefore, conclude that the relations of children to their parents form themselves in different ways with regard to fathers and mothers We seem to be, in this respect, nearer to compensation than to correlation If we know that a youth is in intimate relation to his mother it is less probable that the relation to his father will also be intimate, and more probable that it will be worse, or, if we know that he is in cool or bad relation with his mother the probability of him having better relations to his father is far greater than having the same relation as to his mother The same counts vice-versa for the relation to fathers as regards relations to mothers

Accordingly, there is little or no justification to speak about child-parent relationship in general, the relations of children being different towards mothers and fathers, it is more justified to speak about child-father, and child-mother relationships separately. And, if we remember the differences between boys and girls, shown in previous paragraphs, we seem even justified to speak separately about boy-father, boy-mother, girl-father, and girl-mother relationships

Our statement, of course, is valid, inasmuch as the material studied allows We must keep in mind that the study is based on answers of youths and maidens who have yet to reach their maturity The conclusions drawn from the research of their answers, though interesting in themselves, cannot be considered more than a contribution to the complex psychological problem of child-parent relationship

E SUMMARY

We may now summarize the results of our inquiry in the following conclusions

1 As regards the frequency of different qualitative degrees or classes of child-parent relationship, we obtained this data more than one-third of youths and nearly one-half of maidens depict their relations towards their father as good or even as intimate and friendly, a little over one-fifth of them depict it as reserved (good but with some objections), while one-sixth of boys and one-eighth of girls depict it as cool and strained

2. Sex differences in child-parent relationship have been stated as follows

(*a*) The girls are markedly better in their relations to their fathers than the boys

(*b*) The girls are better also in their relations towards mothers, with one exception in "cool and strained" relations, in which boys are a little better than girls

(*c*). The girls are altogether more often in positive relation to both parents and more seldom in reserved and cool relationship to both parents than the boys

(*d*) The relations of children of both sexes are more often intimate and good, and more seldom reserved and cool towards their mothers than they are towards their fathers.

3 The relation of older children towards their parents are shaped in different ways with regard to the sex of the children and parents The chances of a child being in different relations with his father and mother are greater, as it is seldom that children bear the same relations to both parents. The rule seems to be in this respect nearer to compensation than to correlation.

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CHILDREN'S INTERGROUP ATTITUDES*

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Psychologists, sociologists, and educators are today focusing greater attention on the origin and meaning of prejudice, on its influence on human relations, and on the need for intercultural education

The purpose of this paper is to report a study of trends in children's attitudes toward races, nationalities, and religious groups, and factors causing changes in those attitudes Information concerning children's intergroup attitudes should prove helpful in understanding their origin and should give educators a basis on which to build more favorable attitudes This study will deal with children's intergroup attitudes from 1931 to 1946.

A The Subjects

The subjects of this study were 200 Jewish, Gentile, and a few Negro, 12-year-old children studied in 1931, 12 of whom were followed up in 1933 and 1937; 192 children of the same age and background studied in 1935, 150 studied in 1942, 150 studied in 1943; 174 studied in 1944, and 150 studied in 1946 These children attended a suburban public school in Cincinnati where 82 per cent of the pupils were of the Jewish faith. They were above average in intelligence and in socio-economic background There were also 42 Gentile 12-year-old children of another Cincinnati suburban school, 137 American Apache Indian children ranging from 13 to 17 years in age, from Whiteriver, Arizona, studied in 1934; 59 Cincinnati city high school students, 46 rural northern Ohio high school students, 23 delinquent girls; and 11 Seventh Day Adventist children, studied in 1944

B. Techniques and Procedures

1 The techniques consisted of the Zeligs' Intergroup Attitudes Test which requires the subjects to indicate their willingness to accept members of each of 39 races and nationalities for the relationships of *cousin, chum, roommate, playmate, neighbor, classmate,* and *schoolmate,* by writing YES for the relationship and to express their unwillingness by writing NO for the relationship indicated The index of friendliness was computed by adding the

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"YES's" expressed by all the subjects towards each race and nationality and computing its percentage of the total possible number of "YES's." The total number of "YES's" on the entire test was used as the child's score in inter group friendliness.

2. Intensive personal interviews were given during which the children were tested orally on the Intergroup Attitudes Test and asked to give reasons for their answers They were also asked to name the races and nationalities they liked and disliked very much and to give reasons for their answers, also to tell of any pleasant or unpleasant experiences they had had with members of other races and nationalities The data were used to check the reliability of the Intergroup Attitudes Test and to gain children's concepts, stereotypes, ideas, and knowledge of other races and nationalities and the factors on which they base their attitudes.

3 The children were asked to write true and interesting sentences about each of the 39 groups listed on the test. The data were used to get children's concepts and stereotypes of races and nationalities

4 The children were asked to think of the races and nationalities they liked and those they disliked most, to write them down and give reasons for their answers The data were used to find the most liked and disliked peoples and the children's reasons for those feelings.

5 The tester read the names of the races and nationalities listed on the Intergroup Attitudes Test and asked the children to write the word or phrase that came into their minds, especially words describing the appearance, character, or personality of the peoples mentioned The data were used to obtain children's concepts and stereotypes.

6. The tester read the names of the races and nationalities listed on the Intergroup Attitudes Test and asked the children to express their feelings toward members of each group by writing the number 7 for *like very much*, 6 for *like much*, 5 for *like*, 4 for *don't mind*, 3 for *don't like*, 2 for *hate*, and 1 for *hate much* The numbers for each race and nationality were added and their per cent of the highest possible total score was computed in order to obtain an index of friendliness by means of numerical values

7. The children were asked to write compositions on "What I think of Americans," and "If I could not be an American what other race or nationality I would choose to be and the reasons for my answer" The data were quoted in order to get the children's attitudes toward Americans and other peoples.

8 After taking the Intergroup Attitudes Test the children were asked to go over the list and number from 1 to 5, in the order of their preferences,

the five races and nationalities they liked best, and to write the letters from *A* to *E* before the five least-liked peoples The data were used to find the most-liked and least-liked peoples and to compare the results with data obtained by other methods

C The Findings

1 *General Trends*

The index of friendliness toward races and nationalities expressed by the 12-year-old children from 1931 to 1946 is given in Table 1 At all times *American* heads the list Changes from 1931 to 1935 showed downward trends for *German, German-Jew,* and *Japanese,* and upward trends for *Czechoslovakian, American-Indian, Portuguese,* and *Italian* Downward changes from 1935 to 1942 are found for the *Japanese* and *Italians* There is a general upward trend from 1935 to 1942 with a special increase in acceptability for the *Filipino, Mexican, Negro, Greek, Chinese, Hungarian, Canadian, Spanish, Finn, Irish, and Russian* Of these, the *Spanish* and *Filipino* went down again from 1942 to 1943, with an upward trend for the *Danes, Germans, Dutch, Norwegians, Chinese, Italians,* and *Poles* Three of these, the *Germans, Danes,* and *Norwegians,* were less acceptable in 1944 than they were in 1943 There was also a downward trend for the *Swedish, Portuguese, Arab* and *Hindu* Upward strides were made by the *Italians, Japanese, Filipinos,* and *French-Canadians.*

Most noticeable changes from 1944 to 1946 are downward changes toward *Russian* and upward changes toward *Japanese, Polish,* and *Italian* With these exceptions, the groups maintained about the same rank from 1931 to 1946 The most liked peoples are *American, English, Jew, French, Canadian, Irish, Russian, Hawaiian,* and *South American* Since many of the subjects were Jewish therefore *Jew* ranked high The rank or status of a race or nationality seems to be well set and not easily subject to change, though change does take place under the impact of a dramatic experience like war

Correlations of scores on the Intergroup Attitudes Test with mental, emotional, and personality traits, educational achievement, and social background were all low (4).

2 *Basic Patterns in the Environment*

The reactions of the Apache American Indian children on the Intergroup Attitudes Test showed a pattern similar to that of the Jewish and Gentile children. The sixth-grade children and the city and rural high school stu-

TABLE 1
INDEX OF FRIENDLINESS TOWARDS VARIOUS PEOPLES EXPRESSED BY TWELVE-YEAR-OLD CHILDREN

Race or nationality	Per cent 1931	1935	1942	1943	1944	1946
American	95	97	94	100	98	100
English	82	84	91	91	91	95
Jew	—	—	—	90	90	97
German Jew	80	70	62	—	—	—
French	74	69	71	72	71	81
Russian Jew	73	70	79	—	—	—
Dutch	67	62	60	75	69	77
German	64	39	35	51	44	55
Canadian	60	57	82	86	81	86
Irish	55	54	73	74	72	83
Russian	54	55	71	78	80	71
Japanese	53	46	27	28	37	58
American Indian	52	58	71	72	70	77
Swedish	52	49	62	68	59	72
Polish	52	50	60	69	61	80
Norwegian	50	47	58	72	61	65
Spanish	50	52	71	58	65	78
Scotch	47	48	58	64	60	75
French-Canadian	46	49	59	67	55	70
Greek	44	47	74	69	63	66
Mexican	43	47	76	71	73	83
Italian	42	49	34	43	52	70
Filipino	39	39	81	70	55	75
Hungarian	37	38	60	52	48	61
Chinese	36	40	65	76	75	81
Roumanian	36	37	40	47	41	56
Dane	35	40	37	56	43	55
Turk	35	37	52	52	52	67
Czechoslovakian	31	40	53	59	52	63
Bulgarian	30	33	48	48	43	55
Portuguese	28	35	49	53	40	56
Finn	26	32	52	52	38	51
Arab	24	29	40	47	39	52
Hindu	22	24	39	47	30	45
Negro	21	20	49	44	42	57
Bohemian	14	19	11	—	—	—
Syrian	11	18	23	—	—	—
Armenian	11	11	1	—	—	—
Servian	11	16	1	—	—	—
Mulatto	10	9	1	1	3	9
Australian	—	—	—	77	71	77
Hawaiian	—	—	—	84	77	83
Swiss	—	—	—	79	67	77
South American	—	—	—	79	79	86
Albanian	—	—	—	29	29	23

dents agreed closely in their ranking of over half the groups listed on the test. Since the groups of subjects were small and of different backgrounds, the fact that agreement is found in a large number of cases suggests the existence of a pattern that is deeply ingrained in our children's social environment and is molding their attitudes.

Little difference was found in the average scores on the Intergroup Attitudes Test between the sixth-grade children and the city high school students tested in 1944. The city children had a higher average score than the rural high school children.

3. *Follow-up of Personal Interviews*

A follow-up of 12 children through tests and personal interviews given in 1931, 1933, and 1937, shows only slight positive changes in test scores. Their social distance toward the 39 races and nationalities remained relatively fixed. More specific evidence of the unchanging attitudes is found in the reasons usually given by the subjects to explain their feelings, as indicated in Table 2. The reasons generally given for liking a race are personal membership in it or its similarity to one's own race in language, customs, culture, and color. The children say:

C. W. B. (Girl)

1931. The American nationality is naturally my favorite because it is my own and one must be patriotic.

1933. Americans are very progressive in every way. They are educated and they try to improve themselves. They are very friendly, clean, and make a good appearance.

1937. The Americans show no hatred to other countries but are very patriotic to America.

E. H. F. (Girl)

1931. I like the English because they speak the same language we do.

1933. I like the English because they are like the Americans in customs, dress, actions, and speech.

1937. I like the English race because they are so much like myself in customs and manners.

R. J. H. (Boy)

1931. I want the Germans for every relationship. I have studied them in geography, the way they talk and all about them. They seem to be nice people.

1933. I don't want the Germans for any relationship. I have been hearing lately how they are killing the Jews and stopping their business.

1937. I hate the Germans because they are persecuting, torturing, and crushing the Jews.

E. H. F. (Girl)

1931. The Negro isn't of my race of people. Most of the time white people don't associate with Negroes. They are not clean. Some of the girls are rough and not careful when they play.

TABLE 2

RACES AND NATIONALITIES MOST-LIKED AND MOST-DISLIKED BY TWELVE CHILDREN INTERVIEWED, AND REASONS GIVEN MOST OFTEN FOR THOSE ATTITUDES

Race or nationality	Reason most often given		
	1931	*1933*	*1937*
Jewish	I am a Jew	It is my own race They are cultured	They are my own race They are cultured
American	I am one Are nice people	My own race An industrious race	My own race Are democratic
English	Our ancestors Same language	Like Americans in language, customs Are democratic Are aristocratic	Like Americans An advanced people
Dutch	Clean, friendly Interesting customs	Clean, friendly Interesting	Clean, happy, healthy
Canadian	Nice people	Like Americans Friendly	Are like Americans Friendly neighbors
German	Nice people	Persecute Jews	Persecute Jews and Catholics
Negro	Not clean Black race Not honest	Not clean Stupid Black race	Not clean Low morals Distrustful
Arab	Unfriendly toward Jews	Riots against Jews	Unfriendly toward Jews Ruthless Uncivilized

> *1933* I don't like the Negro race. I know the ones in our school are awful wild. They are an unclean, unpleasant race to have around.
>
> *1937* *In some respects I dislike the Negro intensely beause of their* unclean ways of living, and yet, at times I pity them because people are so prejudiced against them.

Intensive interviews with 12-year-old children yielded significant data on the reasons they give for their attitudes toward different races and nationalities. The factors are given in Table 3.

TABLE 3
FACTORS CHILDREN CONSIDER AS BASES FOR THEIR RACIAL ATTITUDES

1 Customs
2 Costumes
3 Cleanliness
4 Difference in race or nationality
5 Language
6 Religion
7 War-likeness or peace-loving
8 *Curiosity and adventure*
9 Likeness to own people
10 Character traits
11 Civilization and progress
12 Physical appearance
13 Thrift
14 Education
15 History and geography
16 Citizenship
17 Famous people
18 Cheerfulness
19 Sports
20 Allies in war
21 Government and leaders
22 Good neighbors
23 *Sympathy and tolerance*
24 Like all people
25 Ideology
26 Enemy
27 Belonging to a certain race or nationality
28 Knowing them
29 Studied about them

*From the children's sentences, lists, and discussions of most-liked and least-*liked peoples, and from their compositions, it was found that many factors given in 1931 by the children as the bases for their intergroup attitudes were also given by the children studied in 1942, 1943, 1944, and 1946.

Customs

> *1931* The Dutch are so quaint. I like their ways and customs. They keep their houses so cute, tidy, and clean.
>
> *1942* I like the Spanish because of their music and dancing. I like the Americans because of their way of living.
>
> *1944.* I like Cuba for their songs and dances. I like India for their customs and costumes. I like the way the Greeks dress.

Cleanliness

> *1931* I like the Dutch. They are very clean people.
>
> *1943* I dislike the Negro because they are mostly dirty.

Difference in Race or Nationality

> *1931* I like Americans better than anyone. They are our own people and are the best.

1944 As most people dislike the Japanese, so do I These little yellow people are the only kind that have hate all through them

1944 There are no races that I hate or dislike very much There are a few that I don't like as well as others, but I guess I could get on with them all

Religion

1931. I think the Chinese are interesting I like the statues of their Gods that they worship

1943 I like the Jews and Christians because they believe in one God The Japanese and Germans have no fear of God

Curiosity and Adventure

1931 I would like to have a Turk for a chum I would like to learn their ways and games, their schools, lessons, and the way they write

1944. I would like to live in Arabia for I would love its mysterious places

Likeness to Own People

1931. I like the Canadians. They are near us and like us.

1944 The Canadians live very much like Americans. They wear the same clothes and eat mostly American food.

Character Traits

1931. I don't like the Russians because most of them are cruel You always read in stories how cruel the Cossacks are.

1942 I like the Russian ways of living. They are willing to help one another. They never give up hope till their last breath

Physical Appearance

1931. The Chinese are a war-like people I don't like their looks, especially the way the men wear their hair in a braid down the back

1944 Japan has sneaky, yellow people. They are very little and are just like snakes

The influence of the second world war is reflected in the children's favorable attitudes toward allies and unfavorable attitudes toward enemy countries Important factors considered in 1942-46 included the help given to the allies in the war effort, having a free, democratic government, being able to endure the hardships of war and bombings, and having good governments and leaders

The ideas expressed by the children in their compositions, sentences, and association tests in 1931 and 1944 were tabulated to note their concepts and stereotypes for each race and nationality mentioned Their reactions were grouped under *Favorable, Unfavorable, Neutral,* and *Don't Know* concepts

Table 4 gives the children's favorable and unfavorable concepts of *Spanish* for 1931 and 1944.

TABLE 4
CHILDREN'S FAVORABLE AND UNFAVORABLE CONCEPTS OF SPANISH FOR 1931 AND 1944

	Favorable 1931 64%		Favorable 1944 44%
1	Good dancers	1	Gay, jolly, nice, happy, fun-loving, swell, good
2	Like to sing	2.	Beautiful, bright, gay colors, slick dressers, fans, laces, long gowns, castanets
3	Like music	3	Beautiful girls, shiny black hair, dark eyes, flowers
4	Like bright colored clothes	4	Guitars, music, singing, dancing, rumba
5	Make beautiful shawls	5	Fiestas
6	Dress nicely	6	Would like to be Spanish
7.	Are healthy	7	My friend
8	Some want a republic	8.	Nice language
9	Were great sailors	9	Explorers
10	Were great warriors	10.	Once powerful
11	Country full of romance		
12	Are gay		
13	Are intelligent		
14	Good traders		
15	Have beautiful cities		
16	Gave Columbus ships		
	Unfavorable 1931 15%		**Unfavorable 1944 8%**
1	Like bull-fighting	1.	Like bull-fighting
2	Gold-greedy in olden times	2.	Hot tempers
3	Have dark complexion	3	Wars, facists
4	Are an odd race	4	Foreigners
5	Cruel to captured Mexicans	5	Queer language and dress
		6	Tricky, dirty

Space does not permit giving the children's reactions to all the peoples listed.[1] A comparison of the reaction of children in 1931 with those of other children of the same age and background in 1944 is helpful in noting trends, the degree to which racial and national stereotypes persist, and changes that have taken place. In many cases a number of the same concepts were given in 1931 and 1944, thus reflecting the set culture patterns and stereotypes of the children's environment The trend is towards less sketchy pictures in 1944 than in 1931.

In spite of war, hatred, and killing which have made up our children's world recently, they express greater sympathy and interest in all races and nationalities They are better informed and less fearful of the strange and different. The trend is towards a broader outlook, a greater interest and appreciation of all peoples, and a finer appreciation of the true meaning of democracy Although stereotypes still prevail, there are fewer wrong and grotesque ideas, greater interest, less fear, more curiosity and appreciation of people, customs, and cultures that are different Although they believe that humanity and civilization require freedom, justice, and democracy for all, they do not always express a feeling of equality with all peoples Sometimes they express pity, sympathy, condescension, or tolerance Although the children do feel closer to people who are similar to Americans in color, culture, and language, the trend is toward a wider outlook. Children are beginning to feel the need for realizing that we are living in One World and must accept Brotherhood of man as a part of living together peacefully in that world

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[1] Concepts of other races and nationalities are given in Rose Zeligs,' *Trends in Children's Intergroup Attitudes,* unpublished manuscript

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ADULT RECALL OF UNPLEASANT EXPERIENCES DURING THREE PERIODS OF CHILDHOOD*

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A. INTRODUCTION

The preliminary study reported in this paper was conducted to investigate the types of unpleasant experiences recalled by adults from three different periods of childhood The writers felt that such information would be helpful in defining certain aspects of American culture by pointing up some of the unpleasant events experienced in this society by children of different levels of maturity

In 1933 Jersild, Markey, and Jersild (4) reported a study of "worst happenings" as recalled by 399 children between 5-12 years of age They found in the age range investigated that 74 5 per cent of all the responses obtained concerned bodily injury, illness, or possibility of bodily injury No significant age or sex differences were found. The most striking finding in their study became apparent when "worst happenings" were compared with the fears of the same children This comparison demonstrated that there is a "decided discrepancy between conditions which children fear and conditions which are most likely to befall them in actual life " The method of analysis used by these investigators to categorize "worst happenings" was adapted for use in the present research.

Many previous studies have been made of the effect of pleasantness and unpleasantness on learning and recall [1] There is general agreement in these studies that in free recall there is a greater proportion of pleasant than of unpleasant associations However, there is also the happy finding that in everyday living there is a greater proportion of events that are considered pleasant rather than unpleasant in feeling tone There is some disagreement in the psychological literature as to the adequacy of recall of pleasant and unpleasant events, although a number of studies indicate that pleasant experiences are recalled more readily The childhood experiences recalled as unpleasant by the adult subjects employed in the present research were undoubtedly drawn from a large group of experiences subject to the selective

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[1] For a critical review of these studies see Beebe-Center (1) and Edwards (3)

influences of forgetting through retroactive inhibition and, perhaps, emotional "repression." However, there is no reason to believe that such forgetting or inhibition would operate differentially during the three periods of childhood selected for comparative study

The three periods of childhood selected for comparative purposes were the first five years, the 6-12-year period, and the 12-18-year period This division of the first 18 years of life into three approximately equal segments was not entirely arbitrary, since such a tripartition has been made frequently in the psychoanalytic literature. Also, from educational and sociological points of view these three periods of childhood have been considered separable for study in terms of the different acculturation forces impinging on the child in the home, in the elementary school, and in the secondary school and the more formalized social groupings of this period

B Experimental Procedure

1. *Subjects*

The *S*'s were all female college students between 18 and 24 years of age. Fifty *S*'s served for each of the three experimental groups The mean, range, and *SD* respectively of the chronological ages of each group were as follows: (*a*) group recalling unpleasant experiences occurring during the first five years of life, 20 2, 18-24, 1 4; (*b*) during the 6-12 period of life, 20 7, 18-24, 1.5; (*c*) during the 12-18-year period of life, 20.3, 18-24, 1.5. There is some reason to believe from the information available that these three groups were representative samples of a population of female college students enrolled in upper division courses of a large university. They came from homes above average with respect to socio-economic status and education of parents. As such, they probably represent a sampling of young women reared in homes providing above average physical care and educational-social opportunities.

2 *Instructions*

The method used to collect these data was adapted from Bousfield and Sedgewick (2) and is similar to the procedure followed previously by one of the present writers (5) Since in this research it was the content of the experiences that was to be studied rather than the relative rates of producing responses, the calling of time at two-minute intervals served no purpose except to keep the *S*'s involved in the task of recalling unpleasant experiences

The *S*'s were supplied with a pencil and a sheet of 8½" x 11" paper Each *S* was then asked to write her age at the top of the sheet of paper. When this had been completed the following instructions were given

> This experiment is being conducted in order to find out something about a certain type of thinking It will consist of a problem similar to the following I might ask you to write all the names of animals you could think of, and you might write horse, rabbit, lion, and so on You are not being asked actually to do this, but if you were, you would proceed by writing the names of animals in a column at the left of your sheet of paper At intervals I would say, "Draw a line" On hearing this signal you would draw a horizontal line below the last name you had written and then continue writing the names of more animals (Experimenter illustrates procedure to be followed on blackboard) If you had thought of no new names since the last instruction, "Draw a line," you would draw another line anyway (Experimenter again illustrates on blackboard) You are to begin writing as soon as I tell you what kind of things you are to do

The experimenter answered all questions about the procedure. He then gave one of the following three types of instructions

> "1) Now I am going to ask you to list as many as you can of the *unpleasant things* that happened to you *during the first five years of your life.* Your responses may be in the form of words, phrases, or short sentences Please remember to draw a line below your last response whenever I say, 'Draw a line' You may begin 2) of the *unpleasant things* that happened to you when you were *between six and twelve years* of age 3) of the *unpleasant things* that happened to you when you were *between 12 and 18 years* of age "

As soon as the experimenter had given the instructions, he started a stop watch. At intervals of two minutes the experimenter gave the signal, "Draw a line" The experiment was conducted for a 20-minute period, providing 10 two-minute intervals of writing.

Each group of subjects served in only one of the experimental groups, as the data of the second writing session would have been subject to practice effects

C RESULTS

1 *Analysis of Data*

As previously indicated, the categories used by Jersild, Markey, and Jersild (4) in analyzing "worst happenings" reported by children were employed on a tentative basis to analyze the present data In the preliminary analysis new categories were added and all of the categories chosen for the final analysis were defined by drawing sample responses from the *S*'s papers. On the final list two persons working independently showed an agreement of 92, 95, and 94 per cent in the classification of 200 responses from each of the periods of childhood studied

After the final categories were selected and so defined by examples that observer reliability was substantially high, one of the experimenters analyzed all of the responses of the 150 *S*'s into the following categories

1 PAINFUL INJURIES broke my leg, cut my forehead in fall, fell down and hurt my back, sprained my ankle, cutting finger with razor, burned finger on stove, fell off high fence, falling down stairs, cut my hand on tin can, cut leg open in a fall, broke my arm, bruised in an automobile accident, stepped on a long nail, burned badly by a firecracker, fell off pony and broke my elbow, deep head cut, sprained my arm, cut my knee badly, fell on my head on a big rock

2 SENSORY IRRITATIONS taking bad-tasting medicine, having to eat food I didn't like, getting soap in my eyes, taking castor oil, having to *take Milk of Magnesia*, having to take medicine a lot, having to walk to school on very cold mornings, had hives, friend who had halitosis, being terribly hot one summer in the city, cleaning lady with terrible body odor, dead cat under back porch, had to eat spinach, had to take cod liver oil, walking barefoot on cinders, had cramps with menstruation

3. ILLNESS. having chicken pox, being sick, had diphtheria and measles, had scarlet fever, having ear aches, caught pneumonia one summer, almost choked to death with whooping cough, abscesses in both ears, sickness from childhood diseases, having bad colds a lot, had a tape-worm, sick to my stomach a lot, ptomaine poisoning, had a painful mouth disease, having mumps

4 LOSS OF PERSONAL PROPERTY brother breaking my dolls, doll carriage stolen, my pet dog died, my dog was shot for killing chickens, got a permanent stain on my best dress, lost a valuable ring, a boy threw my rain hat down the sewer, bicycle run over by our car, puppy was killed, lost my sorority pin, losing a sentimental object, cat died, lost my glasses, lost watch given as graduation gift, ripping my new dress on a fence

5 CORPORAL PUNISHMENT getting a spanking, getting spanking from grandmother for not minding, was spanked by my father, was spanked good for climbing on garage roof, got my only spanking, whipped for smoking, teacher shook me for passing notes, mother slapped me for spilling water all over front room rug, older sister spanked me for spilling her perfume, slapped by mother for talking back, father shook me for staying out too late, teacher hit me in class

6. ATTACKED BY ANIMALS old rooster flogged me, dog bit me, wasp stung me, snake twined around my leg, got stung by a hornet, chased

by a bull, chased by a large bulldog, horse snapped at me when I tried to pet him, turkey gobbler chased me into the house, neighbor's dog bit me, being knocked down by a large dog

7 FORCED TO DO UNPLEASANT THINGS being put to bed for punishment, having to take naps, being sent to principal's office for punishment, had to practice on cornet, having to go to bed before my sister, sent to bed without supper, had to wear clothes until worn out, having to wash dishes, forced to practice piano lessons, had to practice music lessons, having to kiss relatives, being sent to cloakroom for laughing, sat in corner for punishment, being sent home from school, having to wear brace on my teeth, having to eat foods I didn't like.

8 VERBALLY DISCIPLINED getting "yelled at" by parents, being "bawled out" by mother for missing supper, severe "bawling out" by teacher, "bawled out" for not shoveling snow off walks, scolded by teacher for whispering, teacher said I didn't work up to my ability, often threatened with punishment, mother scolding me, father yelling at me, scolded because of a dirty neck, serious reprimand for swearing

9 FEELINGS OF GUILT threw a rock and hit my baby brother, hit my sister with a brick and felt bad, stole some cookies from pantry shelf, slapped baby brother and he fell downstairs, set fire to haystack and didn't tell, stole and lied and felt guilty, cheated on spelling test, saying I had gone to Sunday School when I hadn't, wouldn't do the dishes when mother was ill, calling my girl friend a name and feeling sorry, said some bad things about my best friend to some other girls, being bad and feeling sorry

10 TEASED OR RIDICULED being ridiculed by children who could play games better, teased by brother because I was fat, ridiculed by teacher in front of class, made fun of because afraid of water, children teased me because I had to wear overshoes to school, friends laugh at me for my fear of climbing, being called awkward by older brother, teased because of my size, kids made fun of my pigtails, teacher made me sing alone and class "tittered"

11 PERSISTENT FEARS afraid my father would die, fear of dogs, fear of being left alone, fear of snakes, fear of storms, afraid of the dark, afraid of policemen, fear of frequent quarrels between parents, fear of strange men, fear of being sick, fear of thunder and lightning, fear of doctors and dentists, being afraid of teachers, fear of failing in school, afraid I wouldn't be liked, fear of mother's dying, fear of having to go to poorhouse

12 FIGHTING WITH PEERS boy hit me in eye with snowball and I chased him, fights with my sister, neighbor girl and I pulled each other's hair, getting beat up by a boy, fights with other children, big quarrel with best girl friend, older girl slapped me and I kicked her, arguments with certain playmates, had frequent fights with boy next door, quarrel with my best friend, quarreled with my roommate.

13 VISITS TO DOCTORS having doctor's examination, had tonsils removed, had my first tooth pulled, tonsil operation, had appendix out, visits to the doctor and dentist, having doctor give me shots, doctor coming to house, having my arm set, having some teeth filled, having an ear operation, had an electric needle treat a wart

14. DEATHS OF RELATIVES AND FRIENDS. my uncle died, friend killed in an auto accident, father died, boy friend killed in war, mother died when I was 13, father killed in an accident, sister died of pneumonia, mother died when baby brother was born, best girl friend was killed, mother died, high school friend killed in action, my grandmother died

15 SCHOOL FAILURE bad grades, got a *"D"* in science, science repeat, got an *"F"* first term in high school, flunked Latin I, failed my chemistry regents, received low marks in English I, flunked several tests, failing to get class assignments in, got 65 in history, got arithmetic problems wrong and cried, had to stay after school to study spelling, bad marks in school

16. REFUSED DESIRED OBJECTS refused a party dress and cried, not allowed to eat candy for a year, lack of new dress, refusal of desired toy, not allowed to go to movies, couldn't take dancing lessons, not permitted to skate on lake, being denied new shoes, not getting a bicycle, refused admission to a certain college, not getting into a sorority, didn't get to take summer vacation, not having an adequate allowance, couldn't go with a certain boy I liked

17 LOSS OF FRIENDS best friend moved away, a girl broke up a friendship between me and another girl, disapproval of a once-good friend, my favorite high school teacher left, lost best girl friend, broken friendship, best friend quit school, old friend moved to another town, my favorite sister getting married and leaving home, serious argument with friend over another friend, had a fight with my best friend, moving away from my friends

18 QUARRELS WITH PARENTS. very serious argument with family, family quarrels over my boy friends, argued with mother, fight with mother over not wearing long stockings, argument with dad over going horseback riding, fight with dad about staying out until eleven, quarrel with parents over a certain boy friend, had a bad argument with mother

19. BROKE UP WITH BOY FRIEND: broken engagement, broke up with boy friend in senior year, dropped friend who wanted to "neck" all the time, lost a boy friend, quit going with boy after two years, broke up with boy because he drank, boy friend became engaged to someone else, lost a boy friend without knowing why

20 FEELINGS OF INFERIORITY being constantly reminded of my inferiority, led a discussion and couldn't hold interest of others, couldn't learn to ride a bicycle, felt ashamed when I had to wear braces on teeth, having feelings of inferiority about size, having girls tell me what was the matter with me, felt inferior because I was so fat, feeling that I was homely, feeling that I was dumb

21. WITNESSED ACCIDENTS saw a friend killed in an accident, my dog was run over when he was following me, saw Cocoanut Grove fire, *saw a man killed*, saw *two cars crash and a woman killed*, saw a friend shot in leg in accident, saw my mother cut hand and fainted

22 LACK OF POPULARITY being ignored by person I liked very much, *not getting initiated into high school sorority*, *wasn't popular with other* girls, wasn't invited to high school prom, lost a high school election, few friends because we moved so much, unfriendliness of girls in new school, wasn't asked to a certain party, no boy friends

23 UNCLASSIFIED responses not falling into the above categories

2. *Findings*

Available for analysis were 721 responses recalled from the first five years of life, 803 responses recalled from the age range of six to 12 years, and 735 responses recalled from the age range of 12 to 18 years Since there were large individual differences in the production of unpleasant experiences, a larger population of *S*'s would probably be desirable in any future study of this type in which detailed analyses were desired. However, the writers believe that the present populations were sufficiently large to demonstrate significant group trends

The results of the analysis of these responses into categories are presented in Table 1 in percentage form. Included in the first six categories are those *unpleasant experiences that the adult S's recalled more frequently from the* first five years of life. Categories seven to 13 include unpleasant experiences that the adult *S*'s recalled more frequently from the age range six to 12 years. Included in categories 14 to 22 are those unpleasant experiences that the adult *S*'s recalled more frequently from the age range 12 to 18 than from either of the other two segments of childhood It may be seen that approximately 10 per cent of the responses did not fall into any of the categories selected for the analysis

Significant comparisons can readily be made by a cursory study of this table However, in order to facilitate such comparisons among the three levels of chronological maturity, certain of the items have been combined into what appear to be psychologically meaningful clusters.

The first of these clusters includes the following types of unpleasant experiences painful injuries, sensory irritations, illness, corporal punishment, and attacked by animals. For the purposes of descriptive exposition, this cluster has been called "unpleasant or painful sensory-and-emotional experiences" Presented in Figure 1 is a comparison of the frequency of recall of the items constituting this cluster in the three chronological-age periods

TABLE 1
PERCENTAGE OF RESPONSES IN THE 22 CATEGORIES OF UNPLEASANT EXPERIENCES

	Types of unpleasant items recalled	During first five years of life	During 6-12-year period	During 12-18 year period
1	Painful Injuries	10.0%	7.6%	6.4%
2	Sensory Irritations	8.9	1.6	0.1
3	Illness	8.4	4.9	5.1
4	Loss of Personal Property	8.4	4.3	3.4
5	Corporal Punishment	7.3	7.1	1.0
6	Attacked by Animals	6.1	1.1	0.0
7.	Forced to Do Unpleasant Things	4.9	15.2	3.4
8	Verbally Disciplined	2.8	9.9	4.1
9	Feelings of Guilt	4.9	7.6	2.1
10	Teased or Ridiculed	2.8	4.9	2.5
11	Persistent Fears	4.4	4.9	1.4
12	Fighting with Peers	2.2	4.3	1.4
13	Visits to Doctors	2.8	3.3	1.0
14	Deaths of Relatives and Friends	1.6	1.6	9.7
15.	School Failure	1.7	4.9	8.3
16	Refused Desired Objects	4.4	4.9	8.3
17	Loss of Friends	2.8	3.3	8.0
18	Quarrels with Parents	0.0	0.5	5.4
19	Broke Up With Boy Friend	0.0	0.0	4.9
20.	Feelings of Inferiority	0.0	0.0	4.9
21	Witnessed Accidents	2.8	0.5	3.4
22.	Lack of Popularity	0.0	0.0	3.4
23	Unclassified (All Others)	12.8	7.6	11.8
	Total	100.0	100.0	100.0

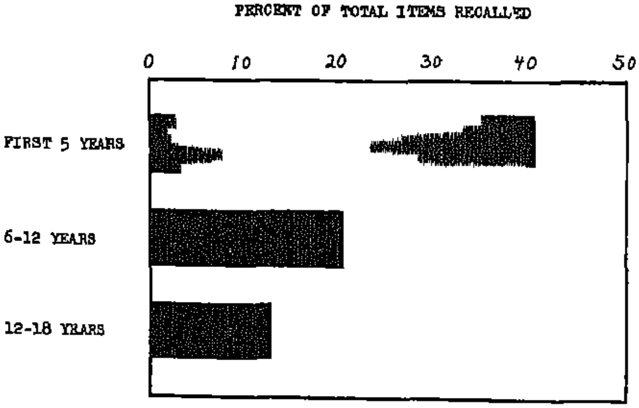

FIGURE 1
UNPLEASANT OR PAINFUL SENSORY-AND-EMOTIONAL EXPERIENCES
[Includes painful injuries (1), sensory irritations (2), illness (3), corporal punishment (5), and attacked by animals (6).]

studied. It may be seen that this cluster of unpleasant experiences was recalled most frequently from the first five years of life. The following $diff/\sigma_{diff}$ ratios were obtained: first five years vs. 6-12 years, 7.03; first five years vs. 12-18 years, 12.2; 6-12 years vs. 12-18 years, 4.84. One can reject the null hypothesis at less than the 1 per cent level of confidence for all three of these comparisons. It appears from these results that adult *S*'s look upon the first five years of life as a period fraught with painful sensory experiences. The experiences that predominate during this time of life are less complex and closer to a pure sensation basis than the unpleasant experiences recalled most frequently from the other two chronological periods.

The second of these clusters includes the following types of unpleasant experiences: forced to do unpleasant things, verbally disciplined, feelings of guilt, teased or ridiculed, and fighting with peers. This cluster has been named "unpleasant experiences during process of learning to live in a social world." In Figure 2 is presented a comparison of the frequency of recall of the items constituting this cluster in the three age groups. This cluster of unpleasant experiences was recalled most frequently from the 6-12-year period of life. The following $diff/\sigma_{diff}$ ratios were obtained: 6-12 years vs. first five years, 10.03; 6-12 years vs. 12-18 years, 12.31; first five years vs. 12-18 years, 2.03. One can reject the null hypothesis at less than the 1 per cent level of confidence for the 6-12 years vs. 12-18 years comparison, and for the 6-12 years vs. first five years comparison. From these results

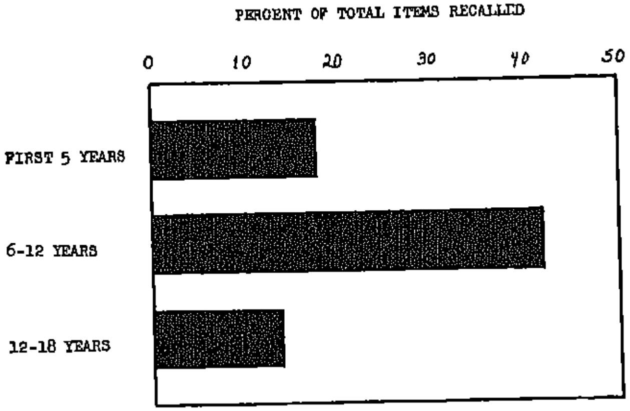

FIGURE 2

UNPLEASANT EXPERIENCES DURING PROCESS OF LEARNING TO LIVE IN A SOCIAL WORLD
[Includes forced to do unpleasant things (7), verbally disciplined (8), feelings of guilt (9), teased or ridiculed (10), and fighting with peers (12).]

one can conclude that unpleasant experiences involving social conflict are more frequent during the 6-12-year period of life. During this period of learning to live with others and to conform to established social ways of life the child is frequently placed in conflict situations that have an unpleasant affective coloring. He is forced to do many things by direct instruction and by more subtle social pressures, and feels guilty when he does not conform to the demands of the social groups to which he belongs. The child during the 6-12-year period of life has moved beyond the stage of "aches and pains" to another stage of "learning the social rules."

The third of these clusters includes the following types of unpleasant experiences: deaths of relatives and friends, school failure, loss of friends, quarrels with parents, broke up with boy friends, feelings of inferiority and lack of popularity. For descriptive purposes this cluster has been called "unpleasant experiences generating feelings of inadequacy and insecurity." A comparison of the frequency of recall of the items constituting this cluster in the three age groups is presented in Figure 3. This grouping of unpleasant experiences was recalled most frequently from the 12-18-year period of life. The following $diff/\sigma_{diff}$ ratios were obtained: 12-18 years vs. first five years, 17.70; 12-18 years vs. 6-12 years, 15.21; 6-12 years vs. first five years, 2.52. One can reject the null hypothesis at less than the 1 per cent level of confidence for both the 12-18 years vs. first five years and the 12-18 years vs. 6-12

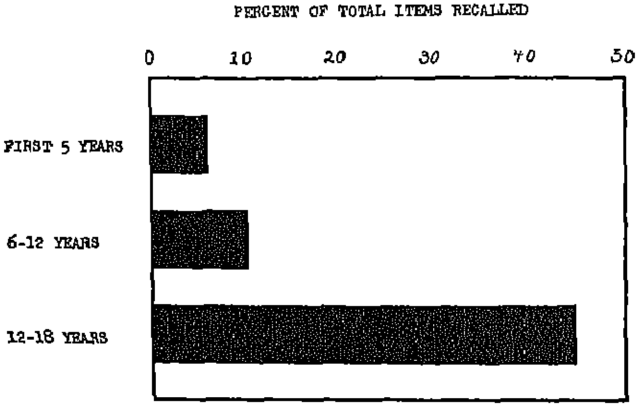

FIGURE 3

UNPLEASANT EXPERIENCES GENERATING FEELINGS OF INADEQUACY AND INSECURITY
[Includes: deaths of relatives and friends (14), school failure (15), loss of friends (17), quarrels with parents (18), broke up with boy friend (19), feelings of inferiority (20), and lack of popularity (22).]

years comparisons. From these results one can conclude that unpleasant experiences involving feelings of insecurity and social inadequacy are more frequent during the 12-18-year period of life During this period of life the individual is aware of his social and emotional dependence on other people He is also aware of himself as a person whom other people evaluate in terms of achievement, popularity, and desirability as a friend. He is frequently in conflict with his parents, yet is still highly dependent on them for social and emotional support. The individual during the 12-18-year period of life has moved beyond the stage of "aches and pains" and the stage of "learning the social rules" to another stage of "attempting to gain, and maintain a satisfactory level of personal status in a social world"

An interesting and fruitful extension of this study would be an investigation of the unpleasant experiences recalled by older *S*'s from various other periods of life; e g, 18-24, 24-30, 30-36, etc, years of life Especially interesting would be an investigation of the 18-30-year span of development during which permanent heterosexual and economic adjustments are usually made

D. Discussion

The findings reported in this paper agree with some of the common-sense observations that one makes in watching children develop in our culture. They also agree with some of the psychoanalytic reports, as they should, since the data collected in this study were obtained by a procedure somewhat similar to certain psychoanalytic interview methods It appears to the present writers that the experimental procedure used in this research has promising possibilities for investigating psychological conflicts typical in our culture for various chronological age groups.

This method of studying culture provides an indirect approach to the problems of individuals as they develop in our society It may be that the study of psychological conflicts mediating a negative affective experience places the individual less "on guard" than asking him to list or check his problems A questionnaire on problems may be a difficult and unpleasant experience for the person who doesn't like to face reality. At least, the present procedure might be given a trial in situations where the individual needs psychological support and is as yet unable to come face-to-face with the problems that are, and have been perplexing him for some time The research possibilities of this method have previously been indicated in this paper For example, one might ask people of various age levels to list all of the unpleasant experiences they have had in the last five years. This procedure would throw light on the conflicts of different age groups and also some of the common conflicts imposed on people of all ages by certain sociological, economic, and political trends, e g , wars, depressions, etc

The results obtained in this study are of interest from a theoretical point of view, however, in addition, they also bear intriguing practical implications for the 6-12-year and 12-18-year periods It seems entirely possible in our culture that too much emphasis has been placed on enforced social learning during the 6-12-year period Perhaps, the socialization process during this stage of development could be fostered just as effectively and with fewer psychological conflicts if approached from a more positive angle than from the restrictive and compulsory point of view mirrored by the present findings It may be that in our culture the individual is being "forced" too rapidly to adapt himself to the current social rules and conventions—a parallel to this being the extreme emphasis on early toilet training for the young child that was accepted procedure some few years past

It is also possible, as a variety of writers have pointed out, that many of the problems peculiar to the 12-18-year period of life may be partially a derivative of the educational, social, and economic philosophy prevalent in this country "You can be at the top of your class," "it's personality that counts," and a host of similarly inane keys to successful living may be sufficient to make the half-boy-half-man during the 12-18-year period feel insecure and inadequate Certainly modern advertising with its warning admonition against bad breath, offensive body odor, dull teeth, sallow complexion, etc., is enough to make even adults feel the threat of loss of social status Perhaps parents, teachers, and other counselors of 12-18-year youth need to instigate counteractive measures to build up the individual's sense of personal worth and to help him set up levels of aspiration in work and social affairs that are commensurate with his abilities and needs One could comment half-facetiously and half-seriously that in such a program of education one might be forced to resort to counter-propaganda of the type that is so effective in promoting the sale of certain brands of soap and toothpaste!

These suggestions do not flow directly from the results of this preliminary study However, on the basis of the present findings and the results of similar research, a strong case can be built for a few of these suggestions It is apparent, at least, to many careful observers in the field of child development that the child in our culture is confronted with problems and conflicts need less in number and broad in scope It is also evident from statistics on mental health in this country that a fairly large number of individuals fail in their attempts to adjust to the complex demands of our society There are sound bases for argument that during these formative and more plastic years of development satisfactory adjustment to our society should be within the reach of as many individuals as possible.

E. SUMMARY

The present preliminary study was conducted to investigate the types of unpleasant experiences that adult subjects recall most frequently from three periods of childhood the first five years, 6-12-year period, and 12-18-year period Three groups of 50 adult subjects were asked to recall for 20 minutes unpleasant experiences from these periods of development The results of an analysis of these data demonstrate several interesting trends From the first five years of life adult subjects recalled more unpleasant experiences of the "pain-and-unpleasant-sensation" type From the 6-12-year period adult subjects recalled more unpleasant experiences related to "learning to live in a social world" From the 12-18-year period the adult subjects recalled more unpleasant experiences generating "feelings of inadequacy and insecurity."

The potentialities of this research procedure for investigating psychological conflicts throughout the life span are discussed Also discussed are certain practical implications of these findings for parents, teachers, and other counselors of youth

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BOOKS

The *Journal of Genetic Psychology*, the *Journal of General Psychology*, and the *Journal of Social Psychology*, will buy competent reviews at not less than $2 per printed page and not more than $3 per printed page, but not more than $15 00 for a single review.

Conditions Only those books that are listed below in this section are eligible for such reviews In general, any book so listed contains one or more of the following traits (*a*) Makes an important theoretical contribution, (*b*) consists largely of original experimental research, (*c*) has a creative or revolutionary influence in some special field or the entire field of psychology, (*d*) presents important techniques

The books are listed approximately in order of receipt, and cover a period of not more than three years. A reviewer must possess the Ph D degree or its equal in training and experience.

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(Wolff, W The Personality of the Preschool Child The Child's Search for His Self New York Grune & Stratton, 1946 Pp 341)

REVIEWED BY LOUISE BATES AMES

This volume represents an attempt to approach the hidden forces and motivations of child behavior In a search for some kind of theoretical structure of the personality of the preschool child, the author has designed new experiments to explore the expressive behavior of children in their spontaneous, verbal, graphic, and dramatic expressions He feels that all expressions of personality by the young child are variations on one theme: the child's search for his self The child does not explore the world only in order to gain knowledge, but also to differentiate himself from his environment

The entire investigation centers upon this one main problem the development of the self. The writer further feels strongly that the two worlds in which the young child and the adult live are isolated from each other and are almost entirely different, so that the child's thought processes, his emotional world, his social life cannot be evaluated from the standards of the adult, but have to be understood from the child's own culture. But, neither similarities nor dissimilarities (between adult and child behavior) can be inferred from surface behavior—we need an exploration of the depth of personality

In attempting to explore the child's inner personality this investigator used methods by which the child "was stimulated to a 'projection' of his personality, just as an image is projected upon a screen." This approach to the depth of personality by means of experiments is called "Experimental depth psychology "

The book consists of three sections, somewhat uneven in treatment Part One entitled "Observation" deals with the mind of child and adult, the emotion of child and adult, the first characteristics of social life, and the child's concept of reality This entire section is written in an entertaining style, and makes agreeable reading, but it is of questionable value to the scientific reader since it is extremely sketchy. The treatment of birth (p.

72) and of death (p 75) are examples of the level at which this material is presented. In regard to death for example, one brief paragraph states that there are "two different kinds of approach to the problem of death" one is the realistic and one is the imaginative, and that many children of the imaginative type "do not like to consider realistically the problem of death but continue to consider it as a state of dreaming from which one can awake." This extremely sketchy information, which covers the ground neither for different types of personality nor for different age levels in the development of concepts of death, is followed by a single example of one child's conversation with his mother about death In this fashion many topics are covered, but very few adequately

Section two, "Experimentation," describes, with many pictorial and verbal illustrations, the basic method of studying the depth psychology of children, that is, eliciting their spontaneous drawing and then interpreting the child's personality from this drawing, considering not only the content and form of the drawing but also the character, direction, and texture of strokes, and particularly taking into account the child's own verbalization about his drawing Particular emphasis is placed on the child's drawing of his family group The author also develops, with illustrations, his concept of the rhythm quotient, a concept which he has previously presented and which he considers valuable in determining the personality of the person drawing

In this section of the book the author labors his point that the methods of depth psychology are necessary since the ordinary intelligence test almost completely fails to give us valid information about the child. He feels that intelligence tests as currently given are inadequate because they do not approach the whole personality of the child, they do not predict future behavior and achievements, the child's emotions may color his answers, the child may give a "wrong" response because he is imaginative, responses vary depending on the child's "adjustment" to the examination situation, and because they do not test the structure of the child but rather what the adult expects of an artificial, child Any or all of these objections may be true of static intelligence tests statically given, but this reviewer does not believe that they are necessarily true of a flexible developmental scale applied with reasonable clinical insight by a competent examiner Such a scale can be nearly as flexible and productive as the methods described in the present volume, but has the additional value that it is probably simpler to teach to examiners in training (Wolff indicates—page 222—the long period of training required for an examiner using his methods to train himself in the empathy which must overcome his natural inner resistances), it yields data in an objective workable form, and it explores more comprehensively the many different aspects of a child's behavior, not just drawing behavior alone

In particular, does Wolff object to using drawings, such as drawings of a man, as tests of intelligence. It seems to this reviewer that a full appreciation of the remarkable similarities in development, from child to child, as the drawings of a man, "incomplete man," or even of simple geometric forms, evolve from year to year in any one child, would give respect for the basic developmental factors (or true indicators of intellectual maturation or development) *which underly the child's creative products, in spite of individual* elaborations which any one child may produce. Even in regard to elaborations (of strokes and words) it is necessary always to keep development sequences firmly in mind since we know that the 4-year-old (for instance) typically elaborates with greater versatility than accuracy, and therefore anyone should be cautious about taking the elaborations of a 4-year-old at full face value

Part Three, "Theory," discusses principles of children's art, the educational bridge between the worlds of the child and the adult, and methods in child psychology. This in some ways seems to the present reviewer to be the best section of the book The chapter on the educational bridge between child and adult is outstanding This chapter gives an interesting analysis of the various psychological approaches to the child contrasted with Wolff's own approach; extremely interesting comments about the illusion of happy childhood, about parents' illusions as to their own rôle in relation to the child and about the value of punishment; a discussion of the danger of the psychology of the "average" child as well as a plea for the individual treatment of the individual child It compares progressive with authoritarian education and discusses various philosophies of education and describes the dynamic education which he himself favors It indicates that the present study "emphasizes not only the unification of approaches in studying the child but also the concept of the unity of the child's personality . . We do not understand a child's thinking if we do not consider it as part of a whole, hence, any isolated approach will necessarily give wrong results." It defines the aim of education as "editing the material" of the child's personality

The last chapter, on Methods in Child Psychology, though brief, also presents extremely interesting material Wolff discusses the different psychological approaches to the study of the child. the developmental, the differential, and the depth. He concludes:

> "It is ultimately the depth approach which leads us to an understanding of the child as an individual" (but) "all these various approaches must be checked and balanced against each other, if an objective and at the same time full understanding of the child is to be obtained . A future child psychology should be based upon converging methods in which the observations and findings of one approach are validated by another approach From the viewpoint of the depth of personality as a goal, converging methods have to be designed because the 'depth' of the individual child has no fixed point but can only be searched for by the cross-point of various reactions. The methods do not consist of an aimless collection and verification of data but are conceived with a view to evolving some hypothesis on the structure of the child's personality The experimenter should not start with any hypothesis whatsoever, but *he should first explore the unknown region of the child's behavior in order to have a hypothesis suggested by the material observed, and not by the observer* "

He concludes

> New methods of investigation are in the process of development, they all have as their aim the understanding of the individual child not so much with reference to other children as with reference to the child's total personality, in which each single manifestation depends on the configuration of all his trends Hence we have to use the most different methods in observing each child, because the pattern of personality can be detected only by converging approaches The detection of different roots in apparently similar manifestations of child and adult, and the detection of the same roots in apparently dissimilar manifestations of child and adult is the experimental task set by a depth psychology of childhood

The greatest flaw in this publication is the author's unfamiliarity with developmental (age) factors (though Wolff himself cautions that "before such tests can be of diagnostic value in individual cases we must know the average reaction of children of a certain age to the different situations"), and with the normal course of the development of drawing behaviors in the child from one to five years It may be true that a knowledge of the meaning of the individual drawing to the child drawing is more useful in interpreting the child to us than are sheer developmental factors, but unless the interpreter is thoroughly familiar with developmental factors, gross inaccuracies of interpretation are inevitable

A few of the inaccuracies (or at least questionable assumptions) which occur because of the writer's lack of familiarity with age trends, are the following:

(p 139) A 2-year-old, when asked to draw her family, drew for "mother" a horizontal line crossed by a vertical stroke For "father" she drew a closed figure with a beautiful curve; while for the "grandmother" she covered the whole paper with confused lines, aimed in all directions . The crossed line for the mother is interpreted as representing a prohibition, the surrounding line for the father represents a protection; whereas "the grandmother is given uncontrolled and confused lines and we may believe that the child's grandmother does not know what she wants, but probably she wants a lot and brings noise and movement to the child"

A simpler explanation of these three forms is that the child has merely retreated or deteriorated, as she draws successive forms, *from "two strokes* for a cross" typical of 30 months, to a somewhat circular form, typical of 24 months, to random scribbling, typical of 18 months Many children do typically deteriorate on successive tasks, giving their best performance on a first trial and then drawing at a younger level in each successive drawing There is a very good chance that a 2-year-old might have drawn these three forms regardless of what three objects he was asked to draw, or might have drawn these same three forms even had he been asked repeatedly to draw the same object

Further, the Table of Graphic Elements in Drawings (pp. 223-226), in which the writer gives his idea of the significance of different kinds of markings, is one of the most striking examples of the need to know basic *developmental trends before working out theories as to the meaning of* behavior Developmental studies have previously shown that preference for drawing lines in certain directions, i.e , top to bottom, left to right, etc , as well as preference for certain types of lines, i e , horizontal, circular, vertical, etc , is characteristic of certain ages during the preschool years, and commonly appears in a predictable order. Beyond the preschool years a preference for certain directions or types of lines may well be significant of individuality factors, but in the preschool years it is not possible to rule out the developmental factors, since the changes are many and rapid in the first five years

A second major criticism is that the book unfortunately abounds in unsubstantiated statements many of which are questionable, many of which are definitely incorrect. A few examples follow.

It is questionable (p 85) that

> the play that children most prefer is being animals. The young child feels himself to be in an interim position He belongs neither to the world of grownups nor to the world of babies He feels himself to be an outsider, a species all by himself, as the animals are As one

> of a minority group, he makes friends with another minority group, the animals; and, knowing that animals may be dangerous and aggressive, he has in them a mighty ally against hostile adults

It is at least questionable (p 217) that

> The preference for horizontal or for vertical movements is also revealing to a certain degree A preference for vertical strokes seems to be characteristic of children who prefer to be in motion, to run around, while a preference for horizontal strokes is shown by children who like to rest or to stay in one place Thus a stroke from left to right, combined with a high pressure, points to tendencies toward leadership, such a stroke, if combined with a low pressure, seems to be more significant of seeking for support A stroke from right to left, combined with high pressure, emphasizes self-determination, if combined with low pressure, isolation and discouragement

This is an interesting system, but it overlooks age and laterality factors and is probably somewhat premature

It is not true (p. 244) that "One observes several factors which all early graphic expressions of children have in common . . . There seems to be a completely incorrect orientation of figures in space; figures which are perceived as standing upright are drawn in horizontal position or mirrored or upside down " This is by no means true of all early graphic expressions and in fact as a rule comes in only briefly at certain age levels That "the child seems to be able to draw forms only if they suggest meaning, if they evoke associations" (p 257) might be true of the "high association" type of child but we have no evidence that it is true of the majority of children.

It is questionable (p 261) that "the adult's spatial orientation is conditioned by experience, the child's by his emotions."

The following statement is extremely questionable (p 262) · "If the child leaves out certain parts which seem not to be important to him, as for instance the trunk in a human figure, he does so from his viewpoint the same as the artist does if he leaves out some unimportant detail. Hence, from his aspect the child acts completely logically" A major difference is probably that the artist could put in the omitted part; we doubt that the younger children are capable of adding a trunk. It is a question of maturity, not of logic or non-logic

We very much question that the remark of the 4-year-old child (p. 141) when drawing his father, "He's not very big, not a very sensible man . That's a silly daddy" should be interpreted as an "astonishingly" accurate description of his father's personality. Four-year-old children customarily make derogatory remarks about their own drawings, "That's a silly boy," "That's a foolish girl," and the remarks are usually considered to refer to the child's own performance, not to the character of the person being drawn

It is true, of course, that nearly any book in this field would contain some statements which a reviewer might be expected to question, and this in itself is not necessarily damaging, but the number of such statements in the present volume is unusually large

A few more general criticisms are as follows·

1. It seems to this reviewer that a different title for the book might have been more satisfactory. "Methods for investigating the personality of the preschool child" would have more accurately described the contents of the book and would not have led to the disappointment which some readers, sharing the now nearly universal interest which child psychologists have in the personality or individuality of the individual child, felt when they discovered that this book gives not the personality of the child but merely suggested methods for finding out about the personality.

2. Though this reviewer agrees with the writer's apparent feeling that a few cases studied thoroughly are preferable to a cursory study of a great many cases, even in an admittedly exploratory study 10 cases, or 20 cases ranging in age from 2 to 10 years, seem a dangerously few on which to base even conjectures It is probable that investigation of larger numbers of cases would modify at least several of the notions suggested here.

3. There is a slight suggestion of a "straw man" here Wolff in emphasizing the value of his approach to the child's inner personality through drawings, exaggerates what he calls the "negative" attitude of adults toward children's drawings He indicates (p. 261) that it is said that the child's art is imitation, that it does not show traces of personal expression, that it represents alogical mental pictures, and that it is determined either by chance or by imitation and not by the child's personality. This reviewer does not feel that "most interpretations of children's art" are in this vein, but rather that the recognition is already widespread that the child's art products are a very good indicator of his personality

4 A major objection to the present method of investigation, as here described is that it seems to yield not the actual personality of the child (in the way that Sheldon gives us the personality of the adult in terms of actual behavior) but rather it gives a personality portrait in the old topically descriptive terms i.e , the child is adaptive, stable, static, tense, forceful, determined, aggressive, dominating, etc., etc (This objection may not hold when the method has been developed farther, but the reader gathers

the impression that results would be in terms of such descriptive adjectives.) It is most valuable to study the "depth" of the child's personality, but we should not lose sight of the fact that as yet very little is known of, and few good methods have been made available for studying, the surface aspects of the child's personality.

One of the most interesting aspects of this book is the author's ability and willingness to consider the depths of the child's personality without deeming it necessary to interpret his findings in terms of Freudian symbolization and Freudian principles Following out his contention that the experiences of the child and the adult are of entirely different natures, Wolff states (p. 39)

> The child's enjoyment of his function of urinating and defecating has been observed very often. Psychoanalysis sees here a manifestation of "urethral" and "anal" erotism Even if these sensations might have some similarity with sexual sensations of the adult, the application of the term "erotism" for the little child seems to be misleading since these sensations play a different rôle for the young child than for the mature personality. The child's delight in his bodily functions seem to correspond to his delight in the nakedness of his own body, but also this delight, which at first glance seems to be similar to that phenomenon which we call auto-erotism or narcissism in the adult, seems to have another structure in the young child His delight in his own body or in his own bodily functions, such as excrementation, is not a "perversion" as Freud would have us believe, who calls the young child "polymorphously perverse," because a perversion appears only if a natural trend becomes channeled in a wrong direction The trends of the little child, however, have had no former direction at all

He further suggests (p 132).

> An analytic procedure is not adequate (to reach an understanding of the child) if the analysis is guided by adult standards This is to a large extent the case in the psychoanalytic interpretation. Psychoanalysis has grown out of an interpretation of adult behavior, and most psychoanalysts have applied their observations directly to analysis of the child without considering that adult and child have different mental structures There is no basis on which to assume that manifestations which have, for instance, a sexual connotation in the adult, have the same sexual motivation in the child even if they appear to be similar What would be termed as aggression or sadism in adults need not have this meaning in the child Behavior which is definitely neurotic in an adult may be perfectly normal for a child of a certain age.

(This same type of thinking, as expressed in the last sentence, would be valuable if applied by the writer to an interpretation of children's drawings, that certain types of behavior may be merely "perfectly normal for a child of a certain age")

The writer's point, stressed throughout and implemented by suggestive conjecture and interesting illustration, that the child is not an undeveloped adult, is excellent, and should be kept constantly in mind not only by the child psychologist but by all adults who deal with children The emphasis which he makes on the importance of finding out what goes on inside the child's mind, what the child's behavior means to him from his point of view rather than ours, is also very good Information of this kind has been all too scant and the methodology suggested here should yield material which could be invaluable to those who are attempting to reach a better understanding of the personality of the preschool child

The book is painstaking and extremely suggestive and, in its insistence that we investigate the inner meaning of the child's behavior to the child and that we remember to make a clear distinction between our own world and that of the child, it makes a real contribution to child psychology. The methodology here suggested may well prove fruitful if the present inaccuracies are ironed out and if due respect is paid to developmental factors

The book is supplemented by an extremely adequate and exhaustive (628 titles) bibliography.

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The Journal of Genetic Psychology, 1948, 72, 137-139

(Johnson, W. People in Quandaries. New York: Harper, 1946. Pp. 532.)

Reviewed by F. C. Sumner

The author of this thought-packed volume approaches the problem of personality maladjustment from the standpoint of general semantics. It is a question of the rôle of language in the origination of the functional disorders of personality. In mistaking words for objective reality is seen the source of maladjustment to reality—a point of view first suggested as recently as 1933 by Korzybski in *Science and Sanity*.

Almost the first half of the present book is devoted to a systematic exposition of general semantics, i. e., the science of language, the basic premises of which are: (*a*) the word is not the object, (*b*) the word does not represent all the object, (*c*) the non-parallelism of words and objects is at its worst in verbal evaluations about verbal evaluations.

Objective reality which is in constant flux undergoes normally a series of distortions, abstractings, abbreviations in being perceived, thought, evaluated, and translated into words. The scientist, asking clear answerable questions in order to direct his observations, which are made in a calm and unprejudiced manner, and which are then reported as accurately as possible and in such a way as to answer the questions that were asked to begin with, after which any pertinent beliefs or assumptions that were held before the observations were made are revised in the light of the observations made and the answers obtained, seeks strenuously to keep to a minimum this disparity between fluid reality on the one hand and his perception, thought, evaluation and language on the other. Quite to the contrary, the non-scientist unwittingly permits his perceptions, thought, evaluations, language to stray ever farther from objective reality. While this estrangement at non-verbal levels is due among other things to the admixture of one's feelings into his observations and evaluations, this discrepancy with reality borders on the pathological at the verbal level where words which at best poorly represent reality are completely divorced from things and even reified. This chasm between words and reality is owing among other things to the general lag in the evolution of language behind the constantly changing character of objective reality, to the overaccentuation of verbalism on the part of our schools, to traditional modes of expression, to verbal stereotypes and shibboleths, to the peculiarity of one's semantic environment, to non-specificity, either-or-ness and synecdoche in the use of words.

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Child Behavior, Animal Behavior, and Comparative Psychology

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SIMPLE DISCRIMINATION BEHAVIOR OF YOUNG CHIMPANZEES: COMPARISONS WITH HUMAN AMENTS AND DOMESTIC ANIMALS*[1]

Yerkes Laboratories of Primate Biology

L. PEARL GARDNER AND HENRY W. NISSEN

A. COMPARATIVE MEASUREMENT OF INTELLIGENCE

The importance, for psychology and for biological theory in general, of evolutionary changes in intelligence has long been recognized, and the problem has stimulated widespread interest and extensive speculations. Nevertheless, there have been very few experimental studies specifically designed to identify the similarities and differences of intelligence at various phylogenetic levels. Most of the available evidence bearing on this question is derived from the comparison of uncoordinated studies, made by different investigators with various species, and using only approximately similar methods. A major reason, doubtless, for the paucity of experimentation in this field is the great difficulty of providing comparable testing situations for the species to be compared.

The ubiquitous problem in all comparative studies of intelligence is to equalize, among the species or groups to be compared, those conditions which affect the expression of the intellectual function in question but which are not a part of it. Factors of motivation, of sensory and motor abilities, and of past experience obviously influence performance in any test of intelligence, and unless this entire "understructure" is functionally equivalent, the test results are no index of relative intelligence among the comparison groups. It has been suggested that such comparisons must be preceded by a determination of optimum conditions *for each group*, that "the maximum is the only point of reference which is available for making valid comparisons" (2, p. 134). The problem of equating the understructure of the intellective function to be examined is a major one when the comparison groups belong to the same species (e.g., human races, economic levels, urban and rural groups, *et cetera*). When several species, differing

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[1] Publication of the Infant Studies Program, supported in part by the Samuel S. Fels Fund. The domestic animals (see Section *D* of this report) were tested at the Cornell University Agricultural Experiment Station, the human feeble-minded subjects at Letchworth Village, Thiells, New York.

radically in size, effector structures, sensitivity, sense-modality dominance, and so on, are to be compared, these difficulties are enormously greater.

An added source of difficulty is related to the incompleteness and uncertainty of present-day psychological analysis We are not prepared to define the "dimensions of intelligence," the basic, irreducible intellective functions or mechanisms which, in combination, constitute intelligent adaptation Even what appears to us as a simple problem situation involves numerous functions (12) , a behavior score is usually a crude, over-all index of a complex of constituent processes. Other things being equal, the more we can "purify" (i e., simplify) the problem situation so that it will test a minimum number of functions, the safer we will be in interpreting comparative data as indicating a discrepancy in such and such a dimension. In the field of learning a start has been made, but only a start, in identifying the several vectors or dimensions along which problem requirements or performance may be measured quantitatively

The classical Pavlovian conditioning situation perhaps comes as close as any to making possible the investigation of relatively simple learning ability—certainly an important element of intelligence—in different organisms with extraneous factors reasonably well equated. Summarizing the evidence, Razran (13) concluded that there is no consistent relation between speed of conditioning (or unconditioning) and position in the phylogenetic scale Lashley, evaluating data obtained by all methods, concludes that "the comparative study of learning in different animals gives little evidence that evolution has brought any change in the rate of formation of the simpler habits" He goes on to say, however, that "there is a fairly consistent rise in the limits of training and in the formation of complex habits with ascent in the phylogenetic scale" (10, p. 468).

B Objectives

In previous papers there have been reported the results of learning tests given under highly similar conditions to horses (3, 5), cows (4, 6), sheep (7), and human aments (8). The situation used in all these studies was a simple one, requiring the association of a signal with approach to a food reward. The signal, a black cloth, was probably quite obtrusive for all the species tested, and the required locomotor response presented no special difficulty for any of them Subsequently, these several groups of subjects were tested in "spatial transfer" situations, the signal being reduced in size and being moved progressively farther away from the location of the reward In the case of the aments only, there was a final test of unlearning, in which the black cloth was made a signal for absence of food reward

A preliminary comparison of the performances of domestic animals and aments was made in one of these papers (8) In order to make possible a more extensive phylogenetic analysis, an "intermediate" group of subhuman primates was added to the series· 10 young chimpanzees were tested in the same set of problem situations as had been used with the aments Section *C* of the present paper is a report of the study with chimpanzee subjects

In Section *D* the data from the previous reports and from the chimpanzee study are brought together for comparative analysis For this purpose we had available data on simple discrimination learning and on two tests of spatial transfer for 41 cows, 44 horses, 11 sheep, 10 chimpanzees, and 50 human aments There were, in addition, the results on two further transfer tests and on an unlearning or reversed-learning problem with the 10 chimpanzees and 50 aments The problems presented to the several groups were, as such, the same. That is, from the viewpoint of the experimenter, the "same thing" was required of all subjects. The situations used meet the desideratum of relative simplicity; that each of them, nevertheless, involved a multiplicity of behavior mechanisms contributing to the scored behavior, seems certain What we have termed the understructure of the intellective functions being tested was equilized for the several groups as completely as was possible (for details see Section *D*) ; no matter how far one goes in this direction experimentally, however, there will always be a residue of difference which must be taken into consideration in evaluating and interpreting the results. In general, Section *D* illustrates and underscores the difficulties inherent in phylogenetic comparisons, and the necessity for caution in drawing conclusions from comparative data—specifically, in this instance, in regard to similarities and differences in intellectual functions.

C CHIMPANZEE STUDY

1 *Subjects, Apparatus, Procedure*

a. Subjects. The 10 chimpanzees had been raised under standardized nursery conditions and had been used in the routine set of physical and behavioral tests and measurements of the Infant Studies Program Details of age, sex, and relationships may be found in Table 1 The experimenter (L P.G.) had utilized these animals in other studies for various periods of time during the eight months preceding this investigation: All had been trained for three months in the use of three mechanical devices For two months Nos. 3, 4, 5, 6, 7, 8, 10 (as numbered in Table 1) were used in pairs in a study of communication, four of these (4, 5, 6, 10) being continued through

TABLE 1

SHOWING AGE AT BEGINNING OF EXPERIMENTATION, SEX, PARENTAGE, TIME SPENT IN PRELIMINARY ORIENTATION, AND TIME REQUIRED FOR INITIAL OPENING OF BOX, FOR EACH OF THE TEN CHIMPANZEE SUBJECTS

Subject No	Subject Name	Age yrs	Age mos.	Sex	Father	Mother	Orientation days	First opening of boxes seconds
1	Karla	3	4	F	Frank	Bula	18	255
2	Fanny	4	2	F	Frank	Nana	18	15
3	Jed	4	6	M	Jack	Wendy	14	20
4	Banka	4	9	F	Frank	Bimba	15	60
5	Scarf	4	10	M	Frank	Soda	14	15
6	Jojo	5	5	F	Jack	Josie	8	5
7	Bard	5	7	M	Bokar	Dita	6	5
8	Jenny	5	7	F	Jack	Wendy	6	5
9	Art	6	3	M	Bokar	Fifi	6	20
10	Ken	6	3	M	Frank	Soda	6	5

another four months in this same study. Other experimenters previously had used Nos 4, 5, 6, 10 for a period of about six months in a study of motivation in a tool-using situation (1), and Nos. 4 and 5 for two months in discrimination of paired geometric stimuli (11) All 10 had been subjects, also, in an observational study of social behavior During the course of experimentation there were two interruptions, during tests on Problem 3 several animals, Nos 4, 5, 6, and 10, were ill with influenza and were not used during the period of illness, and just prior to the retest of original learning the experiment was interrupted for two weeks.

b Apparatus and experimental setting Three food boxes 7½ by 7½ by 4 inches with hinged covers were fastened to a supporting framework, 18 inches apart, with the top edge of the covers 15 inches from the floor. Three "signal boxes," 6½ by 6½ by 4 inches, were placed on the framework directly over the food boxes, with the lower edges 10 inches above the top of the food boxes The framework was set up daily within the living quarters of the subjects, in a section that could be temporarily closed off for the purpose For five animals it was set up in their sleeping quarters, a room 11 by 10 by 9 feet so that the entering animal traversed a distance of 11 feet to the boxes For the other five animals it was set up in a much smaller space, 7 by 5 by 3½ feet, formerly serving as sleeping quarters for three of these, so that the entering subjects walked only three to four feet before opening the boxes. In both situations adequate illumination was furnished by overhead electric lights.

c. Procedure The experimental procedure included five main steps.

(*a*) preliminary adaptation and orientation, (*b*) formation of a simple discriminative response (Problem 1), (*c*) transfer tests and training to new positions of the cue (Problems 2-5); (*d*) retest of original learning (Problem 6), (*e*) breaking down the original habit and establishing its opposite (Problem 7). The details of these main steps are as follows

(*a*) The length of the preliminary orientation depended on the speed of adaptation of the individual and varied from 6 to 18 days (see Table 1), no animal was used in Problem 1 until it would readily go to the boxes, open the lid, and take food As is indicated in the last column of Table 1, most of the animals had little trouble in learning to open the covers of the food boxes Only one animal (No 1) seemed to find the covers a completely new experience and she solved the problem after "accidentally" moving the cover All animals opened the covers readily after their first success

(*b*) Formation of a simple discriminative response *Problem 1* In the initial learning situation (24 trials) a black cotton cloth, 12 by 18 inches, was placed over one of the food boxes as a signal for the fruit reward.

(*c*) Transfer tests and training to new positions of the cue. *Problem 2* The cloth was folded to a size 9 by 12 inches and suspended from the front of the food box, about one inch below the front edge of the cover, 14 trials *Problem 3* The 9 by 12 cloth was suspended from the lower part of the *signal box* so its lower edge was about four inches above the food-box cover, 12 trials *Problem 4* The 9 by 12 cloth was fastened at the top of the signal box so that its lower edge was 10 inches above the food box, 12 trials *Problem 5* The cloth was folded to a size 9 by 6 inches and suspended from an overhanging board so that the lower edge was 16 inches above the food box, 12 trials.

(*d*) Retest of original learning *Problem 6* Six trials, testing retention or improvement of the initial learning, were given under the conditions of Problem 1 above

(*e*) Breaking down the original habit and establishing its opposite *Problem 7* In an unlearning or reversal-learning situation, 48 trials were given with a 12 by 18 cloth over each of two empty food boxes, the third, uncovered box containing a food reward

Two trials were given daily, in the forenoon prior to the first routine feeding The five animals (Nos 1, 2, 7, 8, and 9) using the larger sleeping quarters for trials entered through a small door from the outside cage, while the other five were led by the experimenter from their own cage to the experimental room for each trial When the first trial of the day was completed, the subject was removed from the experimental room while the setting for the second trial was arranged

The position of the correct, baited box was varied in a predetermined, randomized order which was the same for all subjects of this and of the previous studies. The same box was never correct on two successive trials. The reward was a preferred fruit, usually a whole banana or a half orange.

2. *Results*

On any given trial there are three possibilities of response scoring. (*a*) The subject may respond at once to the marked, baited container or box; such a correct, errorless trial is designated as *C*. (*b*) The subject's first response may be to one of the unmarked, wrong boxes, its second response to the correct box; this is designated as a one-box (I) error trial. (*c*) Both "wrong" boxes may be opened before response to the correct box, this being referred to as a two-box (II) error trial. Chance factors alone would give equal frequencies of *C*, I, and II. Since each of the three positions was baited equally often, it is probably safe to assume that any systematic spatio-temporal pattern of response would also lead to an equality of *C*, I, and II responses. Complete failure to learn (Problems 1 and 7) or to generalize learning (Problems 2, 3, 4, and 5), therefore would tend to result in 33 per cent each of *C*-, I-, and II-trials; 33 per cent would be without error, 67 per cent with one or two errors. In absolute terms, the chance scores, per trial, would be .33 each for *C*, I, and II, .67 for incorrect (I and II) responses.

In Table 2 the results from all seven problems are summarized. The figures may be read as percentages or, divided by 100, as mean scores per trial. The two criteria of mastery used require discussion. Criterion *A* is based on the significance of the difference between scores on the *total* number of trials per subject in any given problem (or on the first 24 trials of Problem 7) and chance. In Problem 1, for instance, the chance score would be 8 *C* and 16 incorrect (I and II) trials. The chi-square test was applied to the differences between these figures and the corresponding (raw) empirical scores. When chi-square exceeded 3.841 (indicating significance at the 5 per cent level) a plus sign was entered in Column *A* of Table 2; a minus sign means that this value was exceeded *but* that the number of *C*-trials was significantly *less*, and the number of error-trials reliably *greater*, than chance. An "o" in this column indicates a chi-square value under 3.841. Criterion *B* is based on the *last 8 trials* of Problems 1 and 7 and on the last 8 of the first 24 trials of Problem 7. Chance scores for *C*, and for I and II combined, are 2.67 and 5.33, respectively. Again the chi-square test was applied, a plus (or minus) sign being entered when the value exceeded 3.841.

TABLE 2

Summary of results for each of the ten chimpanzees, and for the group as a whole in the initial learning (Problem 1), the four transfer positions (Problems 2, 3 4, 5), learning re-test (Problem 6), and in unlearning (Problem 7) The percentage of correct or errorless trials (*C*), of one-box errors (I) and of two-box errors (II) are shown (Divided by 100, these figures give the absolute mean score per trial) Columns *A* and *B* indicate whether these scores met the criteria of mastery (+), failed to meet them (o), or indicated performance significantly poorer than chance (—) See text for discussion of Criteria *A* and *B*

	Problem 1					Problem 2				Problem 3				Problem 4			
	24 Trials					14 Trials				12 Trials				12 Trials			
	C	I	II	*A*	*B*	*C*	I	II	*A*	*C*	I	II	*A*	*C*	I	II	*A*
1 Karla	4	33	63	—	—	14	50	36	o	58	25	17	o	50	25	25	o
2 Fanny	50	13	57	o	o	43	21	36	o	42	33	25	o	67	25	8	+
3 Jed	84	8	8	+	+	14	57	29	o	42	42	16	o	25	50	25	o
4 Banka	71	12	17	+	+	43	29	28	o	25	58	17	o	42	25	33	o
5. Scarf	63	29	8	+	+	29	50	21	o	42	42	16	o	25	42	33	o
6 Jojo	50	42	8	o	+	79	21	0	+	100	0	0	+	33	67	0	o
7. Bard	33	50	17	o	+	72	21	7	+	67	33	0	+	92	8	0	+
8 Jenny	25	46	29	o	—	50	21	29	o	50	0	50	o	42	33	25	o
9 Art	33	29	38	o	+	36	43	21	o	59	33	8	o	8	42	50	o
10 Ken	50	33	17	o	+	64	22	14	+	50	17	33	o	33	42	25	o
Average	46	30	24			44	34	22		54	28	18		42	36	22	
No + on criteria				3	7				3				2				2

TABLE 2 (*continued*)

	Problem 5				Problem 6				Problem 7									
	12 Trials				6 Trials				First 24 trials					Total 48 trials				
	C	I	II	*A*	*C*	I	II	*A*	*C*	I	II	*A*	*B*	*C*	I	II	*A*	*B*
1 Karla	50	8	42	o	33	50	17	o	58	17	25	+	+	69	12	19	+	o
2 Fanny	67	8	25	+	33	33	33	o	75	21	4	+	+	75	15	10	+	o
3 Jed	50	25	25	o	33	33	33	o	75	17	8	+	+	81	15	4	+	+
4 Banka	25	42	33	o	50	17	33	o	42	33	25	o	o	44	33	23	o	o
5 Scarf	42	25	33	o	33	50	17	o	42	29	29	o	o	60	25	15	+	+
6 Jojo	25	50	25	o	33	50	17	o	71	4	25	+	+	81	2	17	+	+
7 Bard	84	8	8	+	100	0	0	+	37	21	42	o	o	52	21	27	+	+
8 Jenny	33	33	33	o	33	50	17	o	42	21	37	o	o	46	23	31	o	o
9 Art	33	50	17	o	83	17	0	+	46	29	25	o	+	60	21	19	+	+
10 Ken	58	25	17	o	67	33	0	o	59	8	33	+	+	79	4	17	+	+
Average	47	27	26		50	33	17		55	20	25			65	17	18		
No + on criteria				2				2				5	6				8	6

a. Learning, transfer, and unlearning. As may be seen in Table 2, seven of the 10 subjects met Criterion *B* in Problem 1, and of these three solved the problem early enough to meet Criterion *A*. Only three animals met the criterion in the first of the transfer situations, Problem 2, and in the following three problems the performance of only two subjects was significantly above chance. Bard learned the original discrimination and then maintained mastery in the four transfer situations and in the learning retest. The other two animals (Ken, Jojo) whose scores on Problem 2 were significant had also met the criterion on Problem 1. Jojo learned Problem 1 and successfully transferred this habit to the following two situations. For four of the animals (Jed, Banka, Scarf, and Art) none of the transfer situations, apparently, were the equivalent of Problem 1. Fanny's scores, on the other hand, show no real progress until Problems 4 and 5; it seems probable that her performance in these situations was influenced by training in the previous situations.

The scores of Karla (Criteria *A* and *B*) and of Jenny (Criterion *B*) on Problem 1 are significantly *below* chance. It is not improbable that this avoidance of the marked box reflected a dislike of the cloth—possibly a carry-over from some previous experience. It is of course possible that the scores of other subjects also reflect some degree of cloth-avoidance.

The near-chance performances on Problem 6 (by all subjects except Bard and Art) raise a question as to whether Problem 7 was "unlearning" or "reversal learning" in the usual sense. For Karla, Jenny, and perhaps Fanny, it probably was not, but we believe that for the other seven subjects an unlearning of a previous habit was involved. Problem 7 is the reverse of Problem 1 and these seven subjects had met one or both criteria on the latter. Problem 6 was perhaps too short (six trials only) to permit readjustment from the preceding transfer situations.

Figure 1 shows that, for the group of 10 subjects, the progress of learning in the first 24 trials of Problem 7 was similar to that of Problem 1. It is conceivable that Situation 7 emphasized the "oddity" of the correct box more than did Situation 1 and that oddity as a cue facilitated the learning of Problem 7. The cue of oddity was probably attenuated (reduced in obtrusiveness) relatively more in the transfer situations than was the cue of cloth *vs.* no cloth; to the extent that the chimpanzees *were* responding to oddity, this would explain their poor scores in Problems 3, 4, and 5.

The records of Karla and Fanny (Table 2, Columns *A* and *B* under Problem 7) illustrate a phenomenon, termed "fading" in a previous paper (8, p. 75), and reflected also in the day-to-day score-fluctuations of indi-

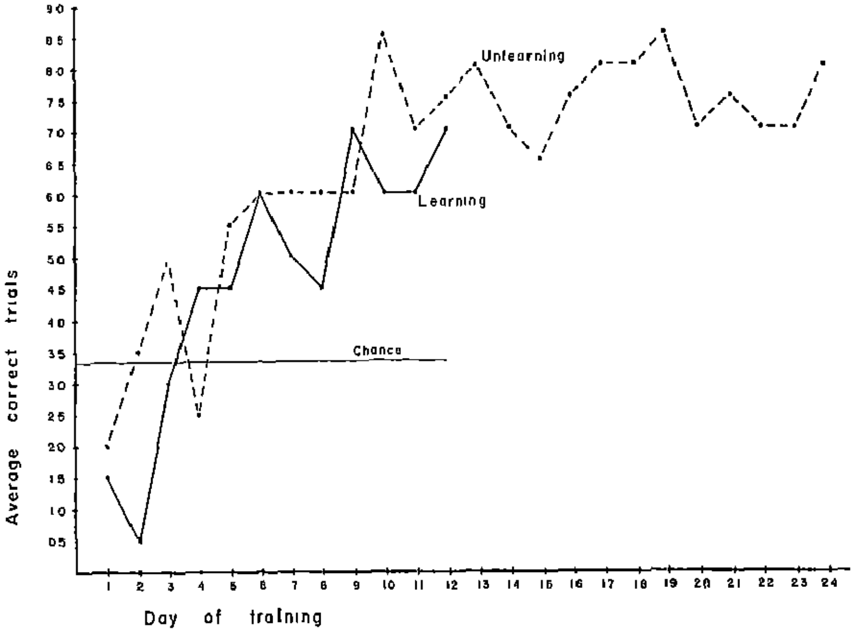

FIGURE 1

AVERAGE NUMBER CORRECT TRIALS ON SUCCESSIVE DAYS (PAIRS OF TRIALS) IN THE INITIAL LEARNING (PROBLEM 1, SOLID LINE) AND IN UNLEARNING (PROBLEM 7, INTERRUPTED LINE)

viduals as well as in the irregularities of the composite graphs in Figure 1 Having apparently mastered a problem, as seen both in the scores and in the assured, self-confident nature of the choice-behavior, the individual subsequently backslides, becomes uncertain, makes mistakes. The correct, adequate basis of response (whatever it may be), once attained, temporarily fades away, or is superseded or overridden by some other behavior mechanism. This phenomenon, of course, is not uncommon in animal experimentation and the "explanations" advanced for it are usually in terms of "fluctuations of attention," or "distraction" Hull's "oscillation principle" and Spence's lawful variations in the algebraic summation of excitatory and inhibitory values accruing to the alternatives from trial to trial have to be strained considerably to account for such relapses *after* the correct response has been maintained over numerous trials

b. Individual differences Various differentiating characteristics in the records of individual subjects have already been noted These animals are subjects in an extensive study of physical and behavioral development and it is expected that comparison of data from this and other experiments eventually may reveal relationships among a wide variety of characteristics and abilities. With this purpose in mind, an over-all evaluation of the 10 chimpanzees according to their performances in this experiment will be presented in this section

In addition to the criteria *A* and *B* used in Table 2, various other yardsticks may be applied in evaluating the relative performance of the individuals. We have ranked the 10 animals according to decreasing number of plus signs (*a*) in all of Table 2, and (*b*) in all of Table 2 excluding the last two columns, according to increasing total number of box-errors (number of I-trials plus twice the number of II-trials), (*c*) in all seven problems, and (*d*) in all seven problems but excluding the last 24 trials of Problem 7, and (*e*) according to decreasing maximum number of *successive* errorless trials in any of the seven problems. These five ranks were averaged, and the averages were ranked from 1 to 10. The results are as follows 1, Jojo; 2, Bard, 3, Jed; 4, Ken; 5, Fanny; 6, Scarf, 7, Banka; 8, Art; 9, Karla; 10, Jenny

The positions of Jojo, Bard, and Jed at the head of the list, and of Jenny at the end, are unambiguous Relative ranks of the intermediate animals could be shifted one or two places by omitting some of the criteria or emphasizing others. It may be noted that, compared to the other subjects, Fanny, Banka, Art, and Ken appeared rather indifferent towards the food reward

c Spatial and other factors As was noted under the section on Procedure, the apparatus was set up in a relatively small space for five of the 10 subjects (Nos 3, 4, 5, 6 and 10), in a larger room for the others. The smaller space apparently favored the original learning of Problem 1, the average number of correct trials for these animals being 63 as compared to 29 for those trained in the larger room In the first two transfer positions and in the unlearning of Problem 7 differences in scores between the two groups were small and variable in direction. In Problems 4 and 5 performance was better in the large room It may be concluded that an initial advantage of the small-room situation quickly disappeared and that when the cloth signal was raised some distance from the floor the larger room was of some advantage, possibly because of the wider perspective which it provided

Analysis of the data reveals that for the group as a whole errors were quite evenly distributed among the boxes in the left, middle, and right positions. Jenny was the only subject who persisted throughout the experiment in a strong preference for one box (the one to her left)

In Table 2 the subjects are listed in order of increasing age It will have been noted already that scores do not vary correspondingly. Using the ranks of Section *b* above, the average rank of the five younger subjects is 6.0; of the five older ones it is 5 0 There is some indication in the data that the younger subjects are superior in learning and unlearning, whereas the older animals make better scores on the transfer problems.

Since our subjects include two full sibling pairs and six half-sibling pairs (see Table 1) opportunity is afforded to investigate the possible manifestation of genetic factors According to the rankings of Section *b* above, the two full sibling pairs had ranks of 6 and 4 (Scarf, Ken), and 3 and 10 (Jed, Jenny). The average ranking of Frank's five offspring is 6 2; of Jack's three it is 4.7, and of Bokar's two youngsters it is 5.0 These figures obviously permit of no conclusions regarding effectiveness of differential heredity

D PHYLOGENETIC COMPARISONS

As mentioned above, 44 horses, 41 cows, 11 sheep, and 50 human aments have been tested previously on Problems 1, 2, and 3. The aments, including both imbecile and idiot levels, have been tested also on Problems 4, 5, 6, and 7. In all these studies, including the present one, the same type of apparatus was used and conditions and procedures were similar (e g., two trials, separated by an interval of about a minute, were given daily; a mild degree of hunger and a preferred food as incentive were used with all the groups; the sequence in which the left, middle, and right boxes were baited was the same for all groups on each problem, and the subjects were all permitted to correct their choices if the first—or first and second—response was to a wrong box) Physically, the only variations of consequence were (*a*) in the distance traversed by the subject, after release, in going to the boxes, this distance being roughly proportional to the size of the organism being tested; and (*b*) in the absolute size of the apparatus, all linear dimensions of that used for horses and cows being exactly twice the dimensions of the apparatus employed with sheep, aments, and chimpanzees

One factor which unfortunately was not held rigidly constant for all comparison groups is the number of trials given on each problem In order to make possible comparison of the several groups, therefore, the data of the earlier studies were recalculated (omitting some of the subjects), and standards of comparison, applicable alike to all the groups, were determined. Each of the 10 chimpanzees was given an equal number of trials on any one problem (e.g., 24 trials each on Problem 1, 14 trials each on Problem 2). The number of trials given to the comparison groups were not always exactly the same and, partly because of illness of subjects or institutional routines, in some cases varied among the individuals of a group. For this reason, the data of subjects who had *fewer* trials on a problem than the chimpanzees were excluded from the comparisons. Furthermore, only the records of trials up to the number of trials given to the chimpanzees were included for those subjects who had had a longer training or testing period. The number of trials on any given problem is thus the same for each of the comparison groups.[2]

The comparative data are presented in Tables 3 and 4. The following eight standards of comparison were computed for all problems except the learning retest, where the small number of trials given makes two of them

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[2] Two questions regarding comparability remain. (*a*) It is possible that, on any problem after the first one, the amount of experience on preceding problems was not precisely the same for each of the comparison groups. We know that each chimpanzee had had 24 trials on Problem 1 when Problem 2 was introduced, but for the other groups this prior training may have differed somewhat in amount. A check was made of this by determining, for those subjects whose records are included in the comparisons on Problem 2, the number of trials given on Problem 1, the averages and ranges are as follows:

Aments	($N = 43$)	average 22.5	range 12-24
Chimpanzees	($N = 10$)	average 24.0	range 24-24
Horses	($N = 36$)	average 21.4	range 12-24
Cows	($N = 12$)	average 24.3	range 18-40
Sheep	($N = 11$)	average 28.2	range 26-32

Experience on Problems 1 *and* 2, for subjects whose records on Problem 3 are compared, were likewise determined:

		Problem 1	Problem 2
Aments	($N = 35$)	22.6 (12-24)	14.8 (10-16)
Chimpanzees	($N = 10$)	24.0 (24-24)	14.0 (14-14)
Horses	($N = 32$)	21.6 (12-24)	17.6 (12-30)
Cows	($N = 25$)	22.6 (14-40)	12.7 (10-14)
Sheep	($N = 11$)	28.2 (26-32)	16.0 (16-16)

The extremes of the ranges are usually represented by only one or two individuals and the discrepancies in averages are slight. One further check was made on this question. There are 11 aments who had exactly the same number of trials on *each* problem as did the 10 chimpanzees. Their average scores were computed separately. Although, as might be expected, these averages show minor deviations from those of the larger comparison groups, there is no case in which the relative ranking of aments and chimpanzees on any of the 8 bases of comparison in Problems 2, 3, 4, 5, 6, or 7 is changed. (*b*) The second question pertains to the possibility of selection in the comparison groups—the possibility, for instance, that the fastest learners among the horses were given less than 24 trials on Problem 1 and were therefore excluded from the comparison group. Such selection did not occur. The length of training-testing of one lot of subjects might differ from that of another group, but any differences within such a group were determined by fortuitous circumstances (e.g., availability or illness) having nothing to do with the performance record.

TABLE 3

Comparative performance scores for human aments, chimpanzees, and domestic animals in Problem 1 (initial learning), problems 2, 3, 4, 5 (transfer situations), Problem 6 (learning retest) and Problem 7 (unlearning)

			Human aments				Animals		
Problem		Measure	trials	Idiot	Imbcl	All	Chimp	Horse	Cow	Sheep

Problem		Measure	trials	Human aments: Idiot	Human aments: Imbcl	Human aments: All	Chimp	Animals: Horse	Animals: Cow	Animals: Sheep
	a)	Avge *C*-trials per trial	24	55	69	65	46	79	68	60
1	b)	Avge *C*-trials in last 8		5 9	6 7	6 4	5 2	7 4	6 9	6 6
	c)	% of group with 6 or more *C*-trials in last 8 trials		60	75	69	70	96	94	82
	a)	Avge *C*-trials per trial	14	62	.80	74	44	80	81	67
2	b)	Avge. *C*-trials in last 8		5 0	6 4	5 0	3 7	6 4	6 6	5 0
	c)	% of group with 6 or more *C*-trials in last 8 trials		40	71	60	20	72	83	45
	a)	Avge *C*-trials per trial	12	65	84	77	54	53	61	50
3	b)	Avge *C*-trials in last 8		5 4	6 2	5 9	4 2	4 3	5 1	4 3
	c)	% of group with 6 or more *C*-trials in last 8 trials		46	77.	66	10	22	44	18
	a)	Avge. *C*-trials per trial	12	60	72	67	42			
4	b)	Avge *C*-trials in last 8		5 0	5 7	5 4	3 7			
	c)	% of group with 6 or more *C*-trials in last 8 trials		31	57	46	30			
	a)	Avge *C*-trials per trial	12	54	.76	68	47			
5	b)	Avge *C*-trials in last 8		4 3	6 0	5 4	4 0			
	c)	% of group with 6 or more *C*-trials in last 8 trials		33	59	50	20			
	a)	Avge *C*-trials per trial Six trials only Six trials only	6	67	93	83	50			
	a)	Avge *C*-trials per trial	24	29	50	42	55			
7	b)	Avge *C*-trials in last 8		3 1	4 9	4 2	5 8			
First 24 trials	c)	% of group with 6 or more *C*-trials in last 8 trials		18.	57.	43.	60			
	a)	Avge *C*-trials per trial	48	31	56	44	65			
7	b)	Avge *C*-trials in last 8		3 3	5 4	4 3	6 0			
Total 48 trials	c)	% of group with 6 or more *C*-trials in last 8 trials		13	50	31	60			

TABLE 4

RANK ORDERS OF THE COMPARISON GROUPS, DERIVED FROM AVERAGE OF RANKS ACCORDING TO EIGHT MEASURES OF PERFORMANCE,* IN EACH OF THE SEVEN PROBLEMS

	Human aments				Animals		
	Idiots	Imbeciles	All	Chimp	Horses	Cows	Sheep
Problem 1	6	3	5	7	1	2	4
24 trials	(10)	(16)	(26)	(10)	(24)	(31)	(11)
Problem 2	6	3	4	7	2	1	5
14 trials	(15)	(28)	(43)	(10)	(36)	(12)	(11)
Problem 3	3	1	2	7	5	4	6
12 trials	(13)	(22)	(35)	(10)	(32)	(25)	(11)
Problem 4	3	1	2	4			
12 trials	(16)	(23)	(39)	(10)			
Problem 5	3	1	2	4			
12 trials	(15)	(29)	(44)	(10)			
Problem 6	3	1	2	4			
6 trials	(4)	(7)	(11)	(10)			
Problem 7	4	2	3	1			
First 24 trials	(17)	(30)	(47)	(10)			
Problem 7	4	2	3	1			
All 48 trials	(8)	(8)	(16)	(10)			

*The group data for three of these measures are presented in Table 3, all eight are described in the text. Plain figures indicate ranks. Figures in parentheses show number of subjects in each group used for comparison in each problem.

inapplicable. (*a*) Average number of correct (*C*) trials, per trial, for total training on the problem. Chance score = 0.33. (*b*) Average number of correct (*C*) trials in the last 8 trials of each problem. Chance score = 2.67. (*c*) Percentage of group with six or more errorless trials in last eight trials. Chi-square = 6.25 or more, indicating significance at the 0.02 level of confidence. (*d*) Average box-error score (number of I-trials plus twice the number of II-trials). Chance score = 1.0. (*e*) Average number of one-box errors (I-trials). Chance score = 0.33. (*f*) Average number of two-box errors (II-trials). Chance score = 0.33. (*g*) Average of the maximum number of successive errorless days by each member of the group. (*h*) Percentage of group with two or more successive errorless days. Standards of comparison numbers *a, d, e, f, g,* and *h,* are based on the total trials in a given problem, numbers *b* and *c* on the final eight trials. Since six correct trials in eight is reliably better than chance by the chi-square test, *c* gives a measure of mastery of each problem by the several comparison groups.

Table 3 shows the first three of these measures of comparison for each group on each of the seven problems. In Table 4 the several groups are ranked from "best" to "worst" on the basis of the average ranking on all eight measures. (For *d, e,* and *f* this is in order of increasing magnitude of the scores, for *a, b, c, g,* and *h* it is in order of decreasing magnitude. As a final step, the calculated average ranks were ranked from 1 to 7 or from 1 to 4)

In the initial learning the domestic animals have the best scores, followed in order by the aments and then the chimpanzees In the first transfer problem the cows and horses still head the list, followed by the aments, sheep, and apes In the second transfer problem the aments take first place and the chimpanzees continue at the bottom of the list In Problems 4, 5, and 6 the aments rank above the chimpanzees, but in the final problem, unlearning, this order is reversed When the aments are divided into the sub-groups, imbeciles and idiots, it is found that the idiots rank just above the chimpanzees on Problems 1, 2, 4, 5, and 6, that on Problem 3 the idiots as well as the imbeciles are superior to all the animal groups, whereas in Problem 7 the chimpanzees had better scores than either sub-group of the feebleminded

Some of the differences between groups are fairly large and are statistically significant The comparative data as a whole, however, indicate differences of degree on a continuum rather than any sharp, qualitative demarcations[3] Scores of the normal human adult certainly would be radically different from any of those included in Table 3 Evidently the mere possession of a symbolic system (language), which may be assumed for the imbeciles, does not insure the full application and exploitation of that mechanism in any and all problem-solving situations

The fact that the horses and cows gave the best original learning scores supports the conclusion that the rate of simple habit formation does not increase regularly from the so-called lower to higher levels of the mammalian series This interpretation obviously involves the assumption that the varying learning scores obtained in this series of experiments reflect differences in learning ability and not merely differences in the behavioral "understructure" which may so greatly affect performance It would be rash to insist that extraneous factors (e.g., motivation, previous experience) were adequately equated in this series. For the time being, however, it seems more reasonable to assume that the scores are primarily a measure of the ability for which the experiment was designed than of factors which the experimenter attempted to exclude.

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[3] The attempt was made to compare the several groups of subjects in terms of the best individuals in each, and in terms of the range of scores in each group It was found that this procedure, which has certain theoretical advantages, made the comparisons meaningless The reduction in the *N* of each group gave undue weight to irrelevant "accidental" factors, a few individuals, for instance, made almost no errors in the first three problems, presumably because of a previously established preference or habit

The ranks of the groups on the first transfer problem are quite similar to those on the original learning, the scores are in general a little better It seems likely that, for all these subjects, the two situations were functionally equivalent As the signal was moved farther away from the location of the food (Problems 3, 4, and 5), performance scores of the aments (idiots as well as imbeciles) become better than those of the other groups To what extent this shift is a function of a wider range of sensory-perceptual equivalence on the part of the aments or, instead, of a greater rigidity in spatial orientation or of a heightened sensitivity to changes in cue-context by the animals, cannot be determined from the available data [1] It was pointed out in Section *C* that the chimpanzees may have been responding to the cue of oddity (to the one box different from the other two) and that this cue became *relatively* less obtrusive in the spatial transfer situations.

It has been observed repeatedly that chimpanzees are extremely sensitive to the slightest changes in an otherwise familiar situation; a new pair of shoes worn by the regular caretaker may temporarily transform the animal's attitude from friendly, confident approach to one of wary avoidance. The enormous effect of displacing the stimulus an inch or two from its usual position in a discrimination problem has been demonstrated experimentally (9) The inclusive scope of chimpanzee responsiveness may sometimes operate as a handicap in problem-solving (12) In the present experiment, the relatively poor scores of the chimpanzees in the transfer situations (Problems 2-5) may have been a function of a prepotent responsiveness to *difference* among the situations rather than of failure to recognize the similarity Such a disproportionate emphasis on one or another aspect of the situation is in itself maladaptive; our intention here is merely to point out the impossibility of identifying unambiguously the behavior mechanism or "dimension of intelligence" responsible for the score-differences

The superior performance of the chimpanzees in Problem 7 is likewise open to several interpretations (*a*) on the basis of the scores, especially in the retest of learning (Problem 6), it is clear that the habit of responding to the cloth-marked box was weaker in the chimpanzees than in the aments.

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[1] It should be noted that in all comparison groups individuals were tested on the transfer problems regardless of their degree of mastery of the original discrimination habit For subjects who had only chance scores on Problem 1, therefore, the next four situations were not transfer problems in a rigorous sense It is clear, furthermore, that Problems 2, 3, 4, and 5 gave opportunity for further learning, the scores suggest that such additional learning may have occurred among the aments, cows, and sheep in Problem 2, and among the aments and chimpanzees in Problem 3

The chimpanzees thus had less of a handicap in acquiring the new habit. The similarity of learning-unlearning scores for the chimpanzees (Figure 1, Tables 2 and 3), and the poorer scores for the aments on unlearning as compared to learning, is consistent with this and the following interpretations. (*b*) In one or more of the chimpanzees a certain degree of cloth-avoidance may have persisted through the training of Problems 1-6. Such a factor would, of course, facilitate the learning of Problem 7. (*c*) As was suggested above, the cue of oddity may have been emphasized more by the use of two black cloths than of one, and this cue may have been relatively more important for the chimpanzees than for the aments. (*d*) It is possible that the chimpanzees manifested a greater plasticity in their adaptation to the changed situation, that they actually benefited from their previous experience in adjusting to Problem 7.

E. SUMMARY

1. *Chimpanzee Study*

Ten young chimpanzees were tested in a series of problem-solving situations which involved, first, the association of an obtrusive signal (black cloth) with an approach response, second, the transfer of this learning to several situations in which the signal was reduced in size and was moved progressively farther away from the location of the food reward, and, third, the unlearning and reversal of the original habit, with response to the box *not* marked by a cloth signal being required.

Seven of the 10 subjects met the criterion of above chance performance in the initial learning problem. Of these, three gave reliable scores in the first transfer situation, two in the second, and one in the third and fourth transfer problems. Responsiveness to oddity is suggested as a possible reason for poor scores on the transfer problems. Eight animals mastered the final, reversed-learning problem. In at least one case, an avoidance (fear?) of the cloth significantly affected performance, this subject gave a statistically reliable below-chance score in the initial learning, a reliably above-chance score in the last problem which required response to the unmarked box. Within the range here represented (3 to 6 years), there was no relation between age and excellence of performance. The subjects included two full sibling and six half-sibling pairs, the data permit no conclusions regarding the influence of differential heredity.

2. *Phylogenetic Comparisons*

The above results on chimpanzees were compared with those previously obtained in the same series of tests using horses, cows, sheep, and human aments (imbeciles and idiots) as subjects This comparison indicates that the domestic animals were superior to the other groups in the initial learning In the later transfer situations the aments gave the best scores The chimpanzees, whose scores on the first parts of the experiment were inferior to those of the domestic animals and aments, did better than either idiots or imbeciles in the final unlearning or reversed learning Although some of these differences are fairly large, there is no indication of any sharp or radical demarcation among the comparison groups These findings are tentatively interpreted as (*a*) giving support to the conclusion that there is no regular increase in the rate of simple habit formation at progressively "higher" levels of the mammalian series, (*b*) as suggesting that the range of equivalence, as the signal is decreased in size and is moved farther away from the food reward, may be wider for feebleminded human subjects than for animals below man, (*c*) as suggesting that the behavior of human aments may be less plastic or modifiable than that of chimpanzees; and (*d*) as indicating that a certain degree of language facility (among the imbeciles) does not insure the application and full exploitation of the symbolic system in all problem situations Alternative possibilities of interpretation are discussed

This study illustrates and emphasizes the two main sources of difficulty inherent in phylogenetic comparisons of intelligence, these probably being responsible in large part for the paucity of experimentation in this important field. (*a*) The intellectual function being examined is manifested in a scored performance which is determined to a great extent by other, "irrelevant" factors, here termed the understructure of the behavior mechanism After this understructure has been experimentally equated as far as possible for the species to be compared, a residue of difference remains which must be taken into account in evaluating the results. (*b*) Even "simple" problems may involve a multiplicity of intellective processes, often making it difficult if not impossible to attribute the performance-difference unambiguously to one or another of the constituent functions It is pointed out, for instance, that (*a*) sensitivity to difference and (*b*) to similarity, as well as (*c*) relative responsiveness to these two aspects of the situation, are factors in determining performance in the spatial transfer problems.

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STUDIES IN WORD-FLUENCY: I. ITS RELATION TO VOCABULARY AND MENTAL AGE IN YOUNG CHILDREN*

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A. INTRODUCTION

1. *Background*

Studies in the word-fluency ability have dealt with older children and adults, and have used written tests. There have been no studies reported on word-fluency in young children.

Thurstone (11, 12, 13) found that verbal ability is made up of two distinct abilities or factors: the verbal-comprehension factor and the word-fluency factor. His interpretation of the factor analysis of tests given to college, high-school, and eighth-grade students is that the verbal-comprehension factor is involved in tests of understanding meanings of words, and the word-fluency factor in tests calling for readiness to produce words to fit a specified set. Johnson and Reynolds (6), in a factor analysis of adult verbal ability, have found what seems to be the same two factors: selection of responses and flow of responses. A "second-order general factor" emerged also from Thurstone's (13) analysis which is identified as probably being the same as Spearman's "*g*." This general factor was most highly correlated with the verbal-comprehension and word-fluency factors (.72 and .62) which suggests that it is basically "linguistic."

Carroll (3) factor-analyzed six tests of word-fluency taken by college students and concluded that there are two factors or abilities in word-fluency: one involving "the speed of word association (usually for common words) where there is some element of restriction of the task imposed—where only one of a certain number of responses from the total reserve is correct", and the other involving "in some way the rate of production for meaningful and syntactically coherent discourse where there is little restriction to definite responses." He considers that neither is identical with Thurstone's word-fluency factor, but that both probably are components of it.

Bousfield and Sedgewick (2) investigated the rate of production of restricted associative responses and found that the rate of occurrence of associative responses, where a set defined the relevance of the responses, varied directly with the difference between the number of responses given and the total number of available responses

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In regard to the differential rate of growth of the mental abilities, Garrett, Bryan, and Peil (5), Asch (1), and Clark (4), working with several groups of children, ages nine to 15 and 11 to 15, have found that the correlations of the tests for the several abilities showed a regular tendency to drop with increase in age Reichard (8), working with groups of children nine, 12, and 15 years of age, found that intercorrelations between eight tests designed to measure the verbal, numerical, and spatial abilities rose from age nine to age 12 and decreased sharply from age 12 to age 15. Clark, using the Chicago Tests of Mental Abilities (12), found also that one of the greatest amounts of change through these age levels was in word-fluency

It has been observed by some investigators (9, 13) that the word-fluency ability is indicative of temperamental traits in addition to its cognitive significance This idea will be explored in a future investigation.

2. *Aim of This Study*

The aim of this study is to construct and use tests for the word-fluency ability of young children and to determine the relationships existing between word-fluency as measured by these tests, and other measures of behavior chronological age, Stanford-Binet mental age, the number of semesters spent by the children in preschool, and the scope of vocabulary of the children as measured by two different types of vocabulary tests It is also intended to determine the interrelationships among these variables.

The working-definition of the word-fluency ability utilized in this study is that it is involved whenever the subject is asked to think of isolated words at a rapid rate; and that it is revealed by readiness in producing or manipulating words in accordance with a specified set

B. PROCEDURE

1. *Subjects*

All children age 5-0 and above (range 5-0 to 6-7) in the preschools of the Iowa Child Welfare Research Station in the year 1945-46 served as subjects in this study. There were 38 subjects, 23 boys and 15 girls, who had a mean chronological age of 68.1 months and a mean Stanford-Binet (Form *L*) *IQ* of 126.2 (range 96-162). The subjects had been in preschool an average of 4.8 semesters (range 1.0-9.5). Their parents were for the most part in professional occupations.

2. *Measures*

Utilizing the concept of word-fluency ability found in the literature (3, 4, 6, 9, 11, 13) as the point of departure, those written tests of the ability used at older age levels were examined and analogous and original tests on the oral level were developed which would be appropriate for young children. These tests were designed to display, as far as possible, the ability of the child to produce words, as distinguished from his ability to understand them. Preliminary trials indicated the attention span of the children for each test from which time limits were set. The tests were treated as a game and were administered in one session which averaged 25 minutes. The tests follow:

1. *Rhymes*[2] Three stimulus sounds were given and the child rhymed as many sounds of real words to each as he was able. An illustration preceded the test series during which the child was encouraged, by examples, to rhyme. Examples were presented with each of the three stimuli of the test series. The stimuli were (*a*)—AIL ("like in mail"); (*b*)—AKE ("like in cake"); and (*c*)—ING ("like in ring and taking"). If "non-real" word rhyme responses were received, after the first two such responses and after each additional such response, the experimenter stated "Now, how about a real word!" When the child paused for 15 seconds at any time, the experimenter said: "Now, how many more can you make like . . . ?" and repeated the correct responses already given. If no acceptable rhymes had been produced, the examples were repeated. Time 1½ minutes allowed for each set. Score. The total of the frequencies of acceptable responses for the three sets.

2. *Alliterations.* Three stimulus sounds were given phonetically and the child was asked to respond with all the real words he could think of that began with that sound. An illustration, in which the subject took part, introduced the children to the medium. The stimuli, and the examples accompanying each, follow: (*a*) B—("like in ball"), (*b*) K—("like in come"), and (*c*) RE—("like in read and return"). Time 1½ minutes for each set. Score. The total of the frequencies of acceptable responses for the three sets.

3. *In the . .* The children responded with words that began with "In the

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[2] The complete procedure for administration and scoring of all the tests is on file in a thesis in the library of the State University of Iowa.

. . ." Time: 1½ minutes Score. The frequency of acceptable responses.

4 *Child names* The child named as many children as he could think of as quickly as he could If the same name was given twice, the watch was stopped and the child asked to differentiate between the two Time one minute Score The frequency (The same procedure was followed for Tests 5 and 6 below)

5 *Adult names.* The child named as many grown-up people as he knew ("any grown-ups, anybody at all, anywhere") as quickly as he could

6 *Thing names* The child named as many things as he knew ("anything that you can think of") as quickly as he could

7 *Disarranged sentences.* Eleven "mixed-up" sentences were presented to the child who was asked to "straighten them out again" In an illustration which preceded the test, the child was aided to straighten out a "mixed-up" three-word sentence The stimuli consisted of two two-word, three three-word, two four-word, and two five-word "mixed-up" sentences If there was no response made when the stimuli were given, they were, if necessary, repeated twice. Time 30 seconds for each sentence Score The scoring was done according to scoring directions in which emphasis was placed on the number of correct word-bridges, i e, two words in sequence in correct grammatical order, and the shifts of subjects and objects to correct positions

8 *Word output* The child was asked to tell all about a subject he probably knew best of all, his home ("about what you do there, how it looks, what the inside is like, who lives there, everything that goes on there—anything at all about your home") When the child paused, the experimenter said: "Anything at all about your home." Everything said that at all related to the home was accepted Time two minutes Scores (*a*) The number of different words used (Types), (*b*) The total number of words used (Tokens), and (*c*) The Type-Token Ratio[d]

Other measures used were Stanford-Binet (Form *L*) mental age, *IQ* and vocabulary subtest scores, and Smith-Williams (14) Vocabulary Test scores The *IQ,* although a ratio with chronological age taken out, was included as a measure because of its common use as a standard. The Smith-Williams Vocabulary Test is a measure based on responses by the child to a representative sample from an adult list of basic verbal symbols Only those responses designated by Williams as recall or "a" responses are used in this study as the measure of vocabulary extent. The scores of 27 children were available on this test.

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[d] The Type-Token Ratio (T T R) is the ratio of the number of different words in a speech sample (Types) to the total number of words used (Tokens) (7)

C. RESULTS

It can be seen from Table 1 that the scores for the 16 variables have fairly adequate (ranges) and (variabilities) for correlational purposes. A possible exception is the Stanford-Binet Vocabulary Test which has limited variability, the range of scores being from 3 to 11. Age 5-0 seems to be the lower limit for testing for the word-fluency ability on these tests.

TABLE 1
Means and Standard Deviations of *CA*, *MA*, *IQ*, Semesters in Preschool, The Smith-Williams and Stanford-Binet Vocabulary Tests, and the Tests of Word-Fluency

(N = 38)	Mean	Sigma
CA (Mos.)	68.1	5.2
MA (Mos.)	86.0	12.1
IQ	126.2	14.5
Terms in Preschool	4.8	2.5
Smith-Williams (N = 27)	40.3	10.8
Binet Vocabulary	6.8	1.8
Rhymes	5.0	5.4
Alliterations	3.2	2.9
In the	5.2	3.5
Child Names	8.3	3.6
Adult Names	5.9	3.4
Thing Names	11.4	6.1
Disarranged Sentences	10.5	7.8
Types	40.5	15.9
Tokens	68.7	29.6
T.T.R. (ratio)	616	140

1. *Correlations of the Word-Fluency Tests with Chronological Age, Mental Age, IQ, and Number of Semesters in Preschool*

In Table 2 it is seen that there is a trend for the tests of word-fluency to be more highly related to mental age than to chronological age. The relationships of the word-fluency tests with the four variables being considered follow.

a. With chronological age. Disarranged Sentences is significantly related at the 1 per cent level of confidence (.55), Rhymes (.34) and Alliterations (.32) at the 5 per cent level. There are slight negative correlations with the Type-Token Ratio (—.30) which just falls short of being significant at the 5 per cent level, and with Types (—.21). It may be said that the older children of this group made higher scores on Disarranged Sentences and

TABLE 2

CORRELATIONS BETWEEN THE TESTS OF WORD-FLUENCY AND *CA*, *MA*, *IQ*, AND NUMBER OF SEMESTERS IN PRESCHOOL*

	Semesters in preschool	Rhymes	Alliterations	In the	Child names	Adult names	Thing names	Disarranged sentences	Types	Tokens	T T R (ratio)
CA	06	34	32	22	09	02	27	55	—21	01	—30
MA	19	62	54	39	37	24	44	65	09	10	00
IQ	19	50	39	32	36	.27	33	41	21	10	19
Semesters in preschool		22	18	—02	—03	18	12	17	06	13	—05

*A correlation of .41 is significant at the 1 per cent level of confidence, and one of .32 at the 5 per cent level

probably were better in rhyming and in thinking of words with given initial sounds. It is likely that the older children were more inclined to use the same words repeatedly in free expression The other tests do not show significant relationships with chronological age.

b With mental age Disarranged Sentences (.65), Rhymes (.62), Alliterations (.54), and Thing Names (.44) all correlate with mental age beyond the 1 per cent level of confidence, In the . . . (.39) is at the 2 per cent level, and Child Names (.37) is at the 5 per cent level The children with higher mental ages may be said to make higher scores on the above named tests Mental age is not related significantly to Types, Tokens, the T.T R. or Adult Names

c. With IQ. The correlations on the whole show the same positive trend as they do with mental age

d. With semesters in preschool. The correlations are insignificant. It is seen that Disarranged Sentences shows a high relationship with *CA*, *MA*, and *IQ*, and that Rhymes, Alliterations, In the . . . , Child Names and Thing Names all show significant relationships with *MA* and *IQ*—the relationships with *MA* being higher.

2. *Interrelations Among the Word-Fluency Tests*

The significant relationships with each of the word-fluency tests are as follows:

a. Rhymes Correlated with Disarranged Sentences (.70) and Alliterations (.42) at beyond the 1 per cent level, with In the . . (.40) and Child Names (.39) at the 2 per cent level; and with Adult Names (.32) and Thing

TABLE 3
INTERCORRELATIONS BETWEEN THE WORD-FLUENCY TESTS*

	Rhymes	Alliterations	In the	Child names	Adult names	Thing names	Disarranged sentences	Types	Tokens	TTR
Rhymes		42	40	39	32	32	70	08	18	—.16
Alliterations			38	33	.11	40	55	.14	20	—17
In the				27	32	45	58	12	13	—17
Child Names					41	.23	34	16	12	08
Adult Names						56	28	45	35	07
Thing Names							51	38	33	—15
Disarranged sentences								08	12	—11
Types									84	04
Tokens										—14
TTR (ratio)										

*A correlation of 41 is significant at the 1 per cent level of confidence, and one of 32 at the 5 per cent level

Names (32) at the 5 per cent level of confidence Relationships with the remaining tests are insignificant

b. Alliterations. Correlated with Disarranged Sentences (55) and Rhymes (42) at beyond the 1 per cent level, with Thing Names (40) at the 2 per cent level, and with In the . (.38) and Child Names (33) at the 5 per cent level.

c. In the . . . Correlated with Disarranged Sentences (58) and Thing Names (45) at beyond the 1 per cent level, with Rhymes (40) at the 2 per cent level, and with Alliterations (38) and Adult Names (32) at the 5 per cent level

d. Child Names. Correlated with Adult Names (41) at the 1 per cent level, with Rhymes (39) at the 2 per cent level, and with Disarranged Sentences (34) and Alliterations (33) at the 5 per cent level

e. Adult Names Correlated at the 1 per cent level with Thing Names (56), Types (.45), and Child Names (41), and at the 5 per cent level with Tokens (35), In the (32), and Rhymes (.32)

f Thing Names Correlated at beyond the 1 per cent level with Adult Names (56), Disarranged Sentences (.51), and In the (45), and at the 5 per cent level with Alliterations (.40), Types (38), Tokens (33), and Rhymes (32)

g Disarranged sentences Correlated at beyond the 1 per cent level with Rhymes (70), In the (58), Alliterations (55), and Thing Names (.51), and at the 5 per cent level with Child Names (.34).

h. Types Correlated at beyond the 1 per cent level with Tokens (84) and Adult Names (.45), and at beyond the 5 per cent level with Thing Names (38)

i Tokens Correlated at beyond the 1 per cent level with Types (84) and the T T.R (—.44), and at the 5 per cent level with Adult Names (35) and Thing Names (33).

j Type-token ratio. Correlated at the 1 per cent level with Tokens (— 44)

3. *Relationships of the Tests of Word-Fluency with the Smith-Williams and Stanford-Binet Vocabulary Tests*

In Table 4 are seen the correlations between the word-fluency tests, the Smith-Williams Vocabulary Test, and the Stanford-Binet Vocabulary subtest (10, p. 302) Two sets of correlations were made with the Binet Vocabulary Test Since scores for only 27 subjects were available on the Smith-Williams and scores for 38 subjects on the Binet Vocabulary, one set of correlations was run with the 27 cases on whom Smith-Williams Vocabulary scores were available and the other set with all 38 cases

TABLE 4
CORRELATIONS BETWEEN THE SMITH-WILLIAMS AND STANFORD-BINET VOCABULARY TESTS AND THE TESTS OF WORD-FLUENCY*

	N	Rhymes	Alliterations	In the	Child names	Adult names	Thing names	Disarranged sentences	Types	Tokens	T T R	Smith-Williams
Smith-Williams	27	76	.55	52	53	26	49	71	.31	19	09	
Binet vocabulary	27	.56	14	00	38	15	10	52	27	—11	07	67
Binet vocabulary	38	.51	07	07	35	17	04	42	07	09	08	

*For 27 cases the value of the correlation coefficient required for significance at the 1 per cent level of confidence is 49, for the 5 per cent level, 38 For 38 cases, 41 and 32

An examination of Table 4 indicates a trend toward high positive relationships (significant at beyond the 1 per cent level) between the Smith-Williams Test and most of the measures of word-fluency· Rhymes (76), Disarranged Sentences (71), Alliterations (55), Child Names (53), In the . (52), and Thing Names (.49). The relationships with the word-output measures, Types and Tokens, and Adult Names are insignificant

The Stanford-Binet Vocabulary Test ($N = 27$) is also related significantly to Rhymes (.56), Disarranged Sentences (.52), and Child Names (.38), but the relationships are lower than the ones between these word-fluency measures and the Smith-Williams Vocabulary Test. The correlations with the Binet Vocabulary Test for 38 cases are, on the whole, somewhat lower than for 27 cases. Those four tests which correlate at beyond the 1 per cent level of confidence with the Smith-Williams Vocabulary Test but not with the Stanford-Binet Vocabulary Test are Alliterations, In the . , Child Names, and Thing Names. However, the correlation of the Binet Vocabulary Test to Child Names is significant at beyond the 5 per cent level (.38).

D. DISCUSSION

Some of the relationships found in this study may be a function of low reliability of the individual measures of word-fluency. The range of scores of the individual measures is not adequate for determining split-half reliability. This consideration could not be overcome by doubling the test lengths. The spans of attention of the children were already almost taxed to the limit, and, as Bousfield and Sedgewick (2) found, the rate of associative responses in a set defining the relevance of the responses varies directly with the number of available responses. It is seen, therefore, that doubling the test lengths would not have solved the problem. Experience with the tests indicates that determining the reliabilities would, with one exception, have involved complete retesting using alternate forms. However, since the ranges of the scores and the patterns of responses were not known in advance, and the time available for this research limited, such a procedure could not be carried out. The Disarranged Sentences test is the only one for which reliability was computed. There are 11 disarranged sentence stimuli. Omitting the odd sentence, an odd-even reliability coefficient of .83 was obtained.

Child, Adult, and Thing Names appeared, at first, to be tapping the same or very similar types of material. We do not know from the intercorrelations whether this is the case. There are some significant intercorrelations, yet, they are not high if we consider them as measures of the same or similar things. It is not indicated in the intercorrelations whether we do not have a reliable measure for each test, or whether the low intercorrelations may mean that they are measuring different things. By inspection, the three tests seem to be tapping response reserves of different magnitudes. A child would be expected to know more names of things than of children, and more names of children than of adults It is seen in Table 1 that the means are in that order

The Type-Token Ratio was included in the analysis to discover its relationships with the other measures It showed only one significant relationship, inverse, with Tokens (—44), which indicates that the children who used a greater volume of words tended to repeat the same words more frequently

Although the other word-fluency measures correlate significantly with mental age, the word-output measures, Types and Tokens, and Adult Names do not. This pattern might indicate that the word-output and Adult Names tests are measuring something different from the other word-fluency tests, something that is not being measured by the Stanford-Binet Intelligence Test From the intercorrelations of the word-fluency measures, it is seen that this pattern is again borne out. With the exception of the relationships of the word-output measures, Types and Tokens, to Adult and Thing Names, significant at the 1 per cent and 5 per cent levels, there are no significant relationships with the other word-fluency measures These results may indicate that there are two abilities involved in word-fluency as Carroll (3) has suggested: one involving the speed of word association where there is some restriction imposed, and the other involving the rate of production of words where there is little restriction That Adult and Thing Names are related to both groups of measures may indicate that they are in some way related to both word-fluency abilities

The two measures of vocabulary were used in this study because of their different natures One, the Smith-Williams, involves the production of words to fit stimulus pictures or objects, and the other, the Stanford-Binet Vocabulary, involves recognition and identification of words. The former would be expected to be related to the word-fluency ability, and the latter to the verbal-comprehension ability.

In view of the correlation of .67 between the Smith-Williams and the Stanford-Binet ($N = 27$) vocabulary tests, it is indicated that the two measures in themselves are fairly reliable.[4] Thus, it may be concluded that their low correlations with other variables are not necessarily a function of low reliability of the word-fluency tests, and that the narrow range and lower variability of the Stanford-Binet Vocabulary Test is not responsible for its low correlations. The age factor is also ruled out as cause for the low correlations, since the Stanford-Binet Vocabulary Test does not correlate with some of the tests with which the Smith-Williams Vocabulary Test correlates It is indicated, therefore, that the insignificant correlations between the Stanford-Binet Vocabulary Test and some of the tests of word-fluency are a function of the nature of those tests, and since some of these same measures are related to the Smith-Williams Vocabulary Test, it is indicated that different groups of tests may be measuring different abilities These data lend support to the evidence cited above as to the existence of two abilities in word-fluency.

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[4] An unpublished study by Wellman shows a correlation between fall and spring tests on the Smith-Williams Vocabulary Test for 40 children to be 94

E SUMMARY AND CONCLUSIONS

1 Word-fluency tests were constructed and used with 38 children, ages 5-0 to 6-7. A satisfactory range of scores was obtained—the individual differences were adequate. Within the limits of this study it was possible to determine the reliability of but one test.

2 The word-fluency tests, in general, had higher relationships with mental age than with chronological age

3. The word-fluency tests gave a positive range of intercorrelations from 08 to 70.

4. Different patterns of relationships were found between the tests of word-fluency and two types of vocabulary tests, one a recall vocabulary test, and the other a recognition-definition vocabulary test

5. The intercorrelations of the word-fluency tests and their correlations with mental age and two types of vocabulary tests seem to indicate that there are two abilities involved in word-fluency one involving the rate of word association where there is some restriction imposed, and the other involving the rate of word association where there is little restriction

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STUDIES IN WORD-FLUENCY II ITS RELATION TO ELEVEN ITEMS OF CHILD BEHAVIOR*

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A INTRODUCTION

In a previous study (1), the relation of word-fluency to mental age and vocabulary, and the interrelationships of the measures of word-fluency were explored It is the aim of this study to determine the relationships between word-fluency, as measured by the same tests, and certain items of child behavior.

The relationship between word-fluency ability and personality has been explored but slightly as yet Thurstone states

> It is not unlikely that the word-fluency factor is indicative of some temperamental traits in addition to its cognitive implications If such double interpretations can be sustained, they will serve to break down the conventional differentiation between intellectual and temperamental parameters, which are probably much more interwoven than we had supposed (4, p 3)

Wolfle (5) surveyed the factors of personality that have been reported in the literature and reported a factor "*f*" for fluency of mental activity, which, presumably, would be the same as, or similar to, the word-fluency ability Studman (3), working with abnormals, reported a fluency factor "*f*" which he thus named because his tests depended largely upon the "flow or fluency of the patient's responses" The nature of the patients' trait characteristics suggested to Studman that this fluency factor is associated with temperament The fluency tests differentiated clearly manic and depressive patients He concluded that they required associative rather than reasoned or logical responses Many patients (mostly depressives) who made low scores on the fluency tests worked extremely rapidly on speed tests (tests consisting of definite and easy tasks to be performed at maximum speed) Studman observed that high speed scores depended largely upon the degree of effort made, whereas on fluency tests effort was a hindrance rather than a help.

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B Procedure

The same 38 children, age 5-0 years and above (range 5-0 to 6-7), who served as subjects, and the same measures[1] of word-fluency used in the previous investigation (1), are utilized in this study As measures of the *temperament or behavior of the children*, a shortened form of the *Fels Child Behavior Scales* (2) was used. Of the 30 scales 15 were chosen for use which, by inspection, were considered to have some bearing on word-fluency, *defined* as being involved whenever the subject is asked to think of isolated words at a rapid rate, and, as being revealed by readiness in producing or manipulating words in accordance with a specified set The scales are independent units, each measuring a single behavior characteristic. The 15 scales chosen measured aggressiveness, cheerfulness, competitiveness, conformity, curiosity, emotional control (the degree to which the child's overt expression of emotion is inhibited), emotional excitability (low threshold to emotional stimulation), fancifulness, frequency of gross activity, gregariousness, originality, patience, sense of humor, social apprehensiveness, and suggestibility. These scales were given to the preschool teachers who rated the children in their groups Ratings by two teachers were obtained for 32 children Only one rating was obtained on the remaining six children since only one teacher was in charge of them. The ratings on four of the scales—fancifulness, frequency of gross activity, sense of humor, and suggestibility —were discarded because the rater reliability on each was at below the 5 per cent level of confidence

The behavior rating scales were made up of nine-centimeter lines—each line corresponding to the child being rated on each behavior characteristic. Cues were present along the lines to aid in the rating The scores were the "X's" placed directly on the rating lines at the points best representing the rater's judgment as to the location of the rates on that scale All the children were rated on each scale at one time Scoring was done by means of an ordinary millimeter rule, by placing it along the rating line and reading the "X" score directly

C. Results and Discussion

1 *Means and Variabilities of the Ratings and Rater Reliability*

The 11 rating scales in Table 1, those retained for use in this study, all have inter-rater reliability coefficients at the 5 per cent level of confidence

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[1] The tests and behavior rating scales used in this study are on file in a thesis in the library of the State University of Iowa.

TABLE 1

Means, Standard Deviations, and Reliability Coefficients for Eleven Rating Scales of Two Groups of Children Measured in the Iowa and Fels Preschools

	Iowa Group (1946)			Fels Group (1939-40)		
	$N = 32$	$N = 38$		$N = 32\text{-}35$	$N = 40$	
Scale	Reliability coefficient*	Mean	Sigma	Reliability coefficient**	Mean	Sigma
Aggressiveness	.80	59.3	20.9	.77	52.8	20.6
Cheerfulness	.40	66.9	18.1	.71	71.7	15.5
Competitiveness	.55	61.4	20.0	.67	51.6	19.3
Conformity	.47	60.6	15.6	.39	67.4	14.7
Curiosity	.62	70.3	17.8	.31	60.3	16.5
Emotional control	.70	58.3	19.9	.59	58.0	19.5
Emotional excitability	.44	69.6	15.9	.56	61.3	15.8
Gregariousness	.40	62.7	18.0	.66	62.3	17.5
Originality	.57	56.4	20.8	.42	44.5	10.9
Patience	.45	56.2	22.4	.70	60.1	23.4
Social apprehensiveness	.65	51.2	20.2	.70	49.2	13.3

*Inter-rater coefficients for two raters

**Inter-rater coefficients for three raters

or higher. These reliability coefficients are not high, but, in general, compare fairly well with the results at the Fels Institute (2). The mean ratings of the Iowa and Fels groups are within fairly close range of each other, the ratings used in this study being slightly more variable, as seen in Table 1. The means and variabilities of the other measures used in this study, chronological age, Stanford-Binet (Form *L*) mental age and *IQ*,

TABLE 2

Means and Standard Deviations of *CA*, *MA*, *IQ*, Semesters in Preschool, and the Tests of Word-Fluency

($N = 38$)	Mean	Sigma
CA (Mos.)	68.1	5.2
MA (Mos.)	86.0	12.1
IQ	126.2	14.5
Terms in preschool	4.8	2.5
Rhymes	5.0	5.4
Alliterations	3.2	2.9
In the	5.2	3.5
Child names	8.3	3.6
Adult names	5.9	3.4
Thing names	11.4	6.1
Disarranged sentences	10.5	7.8
Types	40.5	15.9
Tokens	68.7	29.6
T.T.R. (ratio)	.616	.140

semesters in preschool, and the tests of word-fluency, indicate that these measures are also adequate for correlation

2 *Correlations between the Eleven Behavior Rating Scales and the Measures of Word-Fluency*

The significant relationships appearing in Table 3 between the ratings on the behavior rating scales and the tests of word-fluency ability used in this study follow

TABLE 3

CORRELATIONS BETWEEN THE ELEVEN BEHAVIOR RATING SCALES AND THE TESTS OF WORD-FLUENCY, *CA*, *MA*, *IQ*, AND SEMESTERS IN PRESCHOOL*

	Aggressiveness	Cheerfulness	Competitiveness	Conformity	Curiosity	Emotional control	Emotional excitability	Gregariousness	Originality	Patience	Social apprehensiveness
Rhymes	39	01	56	—13	58	—27	34	48	37	—30	—53
Alliterations	21	32	28	02	23	02	03	25	31	10	—33
In the .	30	.13	26	—08	49	—20	21	12	44	—17	—46
Child names	18	53	31	—12	18	—02	00	37	31	—10	—25
Adult names	06	18	.14	06	34	05	06	40	44	04	—47
Thing names	16	26	21	03	35	15	—09	36	44	07	—50
Disarranged sentences	41	06	48	—19	43	—22	19	36	41	—21	—50
Types	05	26	04	24	17	17	—03	28	26	—10	—.30
Tokens	13	36	05	19	12	14	—02	24	22	—10	—39
T T R (ratio)	—19	—28	—03	—04	01	—10	11	08	—02	—01	23
CA	15	—14	20	—48	—02	—17	—02	11	04	—12	—32
MA	29	12	41	—22	40	—05	08	39	55	—04	—.53
IQ	25	21	34	.04	49	05	12	36	62	03	—28
Semesters in preschool	27	31	22	—12	20	.26	07	24	37	02	—.22

*A correlation of 41 is significant at the 1 per cent level of confidence, 39 at the 2 per cent level, and 32 at the 5 per cent level

a *Rhymes* Correlated with ratings on curiosity (.58), competitiveness (.56), social apprehensiveness (—.53), and gregariousness (.48) at the 1 per cent level of confidence, with aggressiveness (.39) at the 2 per cent level, and with originality (.37) and emotional excitability (.34) at the 5 per cent level Thus, it is indicated that children rated more curious, competitive, gregarious, aggressive and less shy performed better on Rhymes, and also that children rated more original and highly responsive emotionally probably performed better.

b. Alliterations Correlated with ratings on social apprehensiveness (—.33) and cheerfulness (.32) at the 5 per cent level of confidence, indicating that children who were rated less shy and more cheerful probably performed better on Alliterations.

c. In the . . Correlated with curiosity (.49), social apprehensiveness (—.46), and originality (.44) ratings at the 1 per cent level of confidence, indicating that the children rated more curious and original and less shy achieved higher scores on this test.

d. Child names Correlated with the cheerfulness (.53) rating at the 1 per cent level and with gregariousness (.37) at the 5 per cent level, indicating that the children rated more cheerful performed better on the naming of children, and that children rated more gregarious probably performed better.

e. Adult names. Correlated with ratings on social apprehensiveness (—.47) and originality (.44) at the 1 per cent level, with gregariousness (.40) at the 2 per cent level, and with curiosity (.34) at the 5 per cent level. Thus, it is indicated that children rated less shy and more original and gregarious were better in the naming of adults, and that children who were rated more curious probably did better.

f. Thing names Correlated with the ratings on social apprehensiveness (—.50) and originality (.44) at the 1 per cent level, and with curiosity (.35) and gregariousness (.36) at the 5 per cent level, indicating that the children rated less shy and more original named more things and that children rated more gregarious and curious probably named more things.

g. Disarranged sentences Correlated with ratings on the scales for social apprehensiveness (—.50), competitiveness (.48), curiosity (.43), aggressiveness (.41), and originality (.41) at the 1 per cent level of confidence, and with gregariousness (.36) at the 5 per cent level, indicating that children rated less shy and more competitive, curious, and original rearranged better the disarranged sentences and that children rated more gregarious probably did better on this task.

h. Types Not related significantly to any of the behavior ratings.

i. Tokens Correlated with the ratings on social apprehensiveness (—.39) and cheerfulness (.36) at the 5 per cent level of confidence, indicating that the children rated less shy and more cheerful probably used more words per unit of time.

j. T.T.R. The Type-Token Ratio, the ratio of the number of different words used to the total number of words used, did not show significant relationships with any of the scales.

It is apparent from Table 3 that performance on the tests of word-fluency, with the possible exception of Types (— 30) and Child Names (— 25), was better in cases where the children were less shy. The trend holds for all the tests used.

It is of interest to compare the scale relationships of the word-fluency tests that intercorrelated most highly The correlation between Disarranged Sentences and Rhymes is 70 It is seen that children who performed better on Disarranged Sentences were rated less shy (— 50), more competitive (.48), curious (43), aggressive (.41), original (41), and gregarious (36), and those who performed better on Rhymes were rated less shy (— 53), more competitive (56), curious (.58), aggressive (39), original (37), gregarious (48), and emotionally excitable (34). Similar relationships thus are seen to prevail.

The correlation between the Disarranged Sentences and In the tests is 58 Children who performed better on In the were rated less shy (— 46), more curious (49), and original (44) In this case, three of the five scales related to Disarranged Sentences at the 1 per cent level were also significantly related to In the . . .

Adult Names and Thing Names are correlated 56 Children who performed better on the naming of adults were rated less shy (—.47), more original (44), gregarious (.40), and curious (34), and those who performed better on the naming of things were rated less shy (— 50), more original (.44), gregarious (.36), and curious (35) It is seen in this case that very similar relationships prevail between the behavior rating scales and these two word-fluency tests.

From the above data it is concluded that many of the measures used for word-fluency ability are significantly related to characteristics of personality or temperament as measured by the behavior rating scales This would suggest that the word-fluency ability, or one of the abilities involved in word-fluency, is a function of temperamental as well as intellectual traits.

It is necessary to bear in mind, however, in considering the relationships discussed in this section, that reliability of the word-fluency measures is known in only one case (Disarranged Sentences, .83), and that some of the low relationships found may be a function of low reliability of the tests as well as of low reliability of some of the ratings. In the previous investigation (1), it was seen that the relationships found with the tests of word-fluency were not necessarily a function of low reliability of the tests

3. *Correlations between the Eleven Behavior Rating Scales and Chronological Age, Mental Age, IQ, and Semesters in Preschool*

It is seen in Table 3 also that significant relationship patterns exist between some of the behavior ratings on the scales and chronological age, mental age, *IQ*, and the number of semesters spent by the child in preschool. The significant relationships of the ratings with the four variables follow.

a. Chronological age. Correlated with ratings on scales for conformity (—.48) at the 1 per cent level, and with social apprehensiveness (—.32) at the 5 per cent level, indicating that the older children were rated less conformist and probably less shy.

b. Mental age. Correlated with ratings on originality (.55), social apprehensiveness (—.53), and competitiveness (.41) at the 1 per cent level, and with curiosity (.40) and gregariousness (.39) at the 2 per cent level, indicating that the children with higher Stanford-Binet mental ages were rated more original, competitive, curious, gregarious, and less shy.

c. IQ. The correlations at the 1 per cent level of confidence with *IQ* are originality (.62) and curiosity (.49), and at the 5 per cent level gregariousness (.36) and competitiveness (.34), indicating that higher *IQ* children were rated more original and curious and probably more gregarious and competitive.

d. Semesters in preschool. Children who spent more time in preschool were probably rated more original (.37), the correlation being at the 5 per cent level of confidence.

It is seen that ratings on originality are significantly related to mental age, *IQ*, and number of semesters in preschool, but not to chronological age, and that children with higher mental ages were rated more competitive, curious, and gregarious, while ratings on these scales are not significantly related to chronological age. Ratings on conformity show an inverse relationship with chronological age and a trend for such a relationship with mental age. It is noted that no significant relationship was found between mental age and chronological age and scales for aggressiveness, cheerfulness, emotional control, emotional excitability, and patience. An inverse trend is noted between the ratings on shyness and the four variables.

The relationships of the ratings with mental age and *IQ* raise the questions as to whether (*a*) higher mental age and *IQ* children are more competitive, curious, gregarious, original, and less shy because they are more "intelligent," or, (*b*) because they are more competitive, original, curious, gregarious, and less shy they perform better on tests and get higher mental ages and *IQ*'s, or, (*c*) the higher mental ages and *IQ*'s are obtained as a result of some interaction between ability and certain personality variables.

D. SUMMARY AND CONCLUSIONS

1. Correlations between tests of word-fluency, chronological age, mental age, *IQ*, number of semesters in preschool, and 11 behavior rating scales were determined, and some significant relationships were obtained.

2. Children with higher chronological ages were rated less conformist and less shy, and children with higher mental ages were rated more original, competitive, curious, gregarious, and less shy.

3. Correlations between scores on the tests of word-fluency and the behavior ratings ranged from .00 to .58.

4. It is indicated that word-fluency ability, or one of the abilities involved in word-fluency, as measured by the tests used in this study, may be a function of temperamental as well as intellectual traits.

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VERBAL APTITUDES VERSUS ATTITUDES CASE STUDIES XI-XIV*

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The case studies (I-X) on this general topic which have already appeared (6, 8, 9, 10), have been concerned with individuals selected on the basis of certain traits psychiatrically assigned, and with no reference to performance of a psychometric character, or to any other feature in the history. In the present paper this scheme is reversed, the cases are selected on the basis of disjunctions in verbal and quantitative test records, and without reference to any other features of the history The test procedures thus involved are essentially (*a*) The Scholastic Aptitude and Mathematical Attainments Test of the College Entrance Examination Board, (*b*) The verbal and number portions of an alpha test (resembling "Form 9" [5], but available in alternate forms), and (*c*) a vocabulary procedure based on O'Connor's (4) modification of the Inglis series

CASE XI

This man is the younger of two children of upper middle class status The antecedents do not show the outstanding verbal-intellectual capacities here noted, they are fairly balanced between ideational, business, and social interests. There is no evidence of any specially intellectual atmosphere in the home, but the sib resembles the present case intellectually, from description would have more of the Pragmatic and Vital Affect traits and a somewhat less high intellect The influence of institutional religion has been strong in the family, and Case XI when under observation had shown no tendency to move away from it

He apparently over-reacted to ideational stimuli as quite a young child Until late childhood the play contacts were predominantly and perforce with girls, there seems to have been no difficulty in adjusting to boys when this opportunity became available Later social contacts seem, however, to have been more restricted, and the developing ideational interests are specifically named as a reaction to this

Athletic participation has been not quite absent, but is well below group

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average, limited to a few non-contact games, and non-competitive activities. At the time of observation, exercise formed no part of his activities and social participations were slight. There have been no mechanical interests, and there is again encountered a statement of aversion to the rigidity of scientific thinking, and a need for the greater semantic elasticity of words.

As initially seen here, a noteworthy feature is the varying way in which he impressed the different members of the Study staff, given in such comments as (*a*) "slow, rather naïve, not very adequate impression"; (*b*) "talkative, friendly", (*c*) "ideationally fertile, but not orderly; rather ill-balanced"; (*d*) "self-assured, pleasant and agreeable", (*e*) "loud, flighty."

Body-build was of meso-, endo- and ectomorphy in this order with somewhat diminished masculine component.

Psychotype, in spite of higher mesomorphy, would have placed cerebrotonia first, but it is rather mixed according to the functions that one considers (athletics, food, sleep, sex habits, etc.). As already recorded (11, Case 11-D, p. 229) physiology yielded a high pulse with low respiratory and basal metabolic rates. The assigned Soundness Class was *A*, a little liberally perhaps; the Outstanding Traits were limited to Verbal Facility, Cultural and Creative-Intuitive. Viewing the rest of the Woods trait series in the light of the history, one would give an above average rating to Sociable, Sensitive Affect, Ideational and Lack of Purpose and Values, a minus rating to Just-So, Practical Organizing, Pragmatic, Self-Conscious Introspective, Physical Science Motivations.

Demeanor in the psychiatric interviews had rather hypomanic characteristics, a good deal of motor restlessness is described, with marked push of speech, and a low threshold of utterance, so that a word from the interviewer is good for many minutes of rambling talk and it is difficult to terminate an interview. Despite this loquacity, it is a recurring theme in the record that he does not personalize or empathize this talk. It is in terms of "what others say and how others feel" about a thing. This tends to give an "impression of coldness and analytical intelligence with a certain lack of warmth and depth not accompanied by any emotional overlay."

Test Observations

This man presented an *SAT* 1.46σ above local norm and *MAT* 2.9σ below. This is one of the extreme disjunctions in the material, both these tests are rather loaded with cultural features, *MAT* indeed with specific training, and are thus functions of attitudes as well as aptitude. The alpha scores must be understood in relation to this fact. The verbal alpha score is only just average for the college as a whole, not more than half a sigma low for the Study year group. The excessive *SAT* is a function of interest and application, as is further demonstrated in the vocabulary range function, which is 1.13σ high, actually close to the ceiling of the test and one of the higher records in the Study. Quantitation as represented in number alpha, drops to 1.63σ low. As to test profiles, the verbal series is best in same-opposites, and lowest in analogies; a verbalist feature, but the mixed sentences should have been better to be typical. The number profile is best in the simple computational work of addition, characteristically low in reasoning, also in the highest common factor, which seems to have been a comparatively rational function for this man. The motor tensions above noted apparently contribute to a good performance, nearly a sigma fast, for the easy block assemblies. The difficult ones are .67σ slow, including one failure to assemble.

The Rorschach response has various special features. There is over-qualification which can be looked on as part of his loquacity, rather than as an anxiety reaction, for this there would be no other basis. This accessory verbiage would also keep down the response number, but hardly to the extent observed, 1.5σ below mean for his Study group. It is the most constricted pattern of the present cases, with no Human response, movement or otherwise, notably vague form level and over-reaction to color (no *FC*), shown in both inhibition and description in response. Neither can the loquacity as such be held to account for the large amount of "reservation" that appears, e.g., "If these are the legs, they are too long for the rest of it", "all wrong in the proportion of red", "but it is not the right shape." The richness rating would be fair, but the pattern suggests a less integrated personality than has appeared behaviorally.

The handwriting appraisal of this individual is among those in which there is relative disagreement with the psychiatric judgment. Among the expressions thus confirmed are, conative strength, approachable, friendly, good perception, imagination not high, extraverted, *fairly high ethical standards*, cultural, determined without being dynamic. "I should not be surprised if his field were . . " (What it is). The psychiatrist characterized this account as "good, nothing left out or wrong in this." This is hyperbolic, the loquacity for example is missed, there are failures of pickup, but no real "false positives."

Later Record

This man graduated in course, receiving honor grades almost entirely, but essentially confined to verbal topics. He partially earned his way.

Entering the armed services with maximal aptitudes relatively similar to those of Case III, the assignment was of a technological nature, decidedly contrary to both aptitudes and motivations, it says much for his adaptability that he made the comparatively good adjustment that there was. The previous adjustment rating of Difficult (11, p 220) would have become Normal, after a shift of duties more in accord with aptitude and motivations There was overseas service, but no combat

Since separation from the armed services, the career plan has developed promisingly along the lines of principal motivations, with a reasonable balance of outside interests. These appear practically confined to the arts and letters field, in Sheldonian terms the cerebrotonic component is still represented as dominant, with the other two rather in the background At present the original *A* soundness rating appears to have justified itself

Case XII

This man is one of three children (7, "C," pp. 75-77), the socio-economic situation best described as "upper middle" The father's field is applied science, but with some cultural interests of a verbal nature These latter have apparently fostered rather than determined the like motivations of the son The mother's concerns are business and social rather than intellectual Nothing in the previous antecedents resembles the distinctive pattern of abilities present in this case. Neither do the sibs resemble him in other respects besides the present essential one; there is generally more somatotonia and less viscerotonia.

Highly ideational and comparatively asocial traits in this case were apparent during early years. This cannot be accounted for by rejection in the home, there may subsequently have been hostile reaction to certain disciplinary measures, but it was a reasonably integrated establishment, with perhaps more self-sufficiency among its members than is usual It must also be emphasized that there was no rejection by companions, nor shyness towards them In secondary school there developed some feeling that this self-sufficiency might be carried too far, and he "forced" himself to take part in certain very socialized school activities, in which he was successful, and liked The "pleasure in irregularity" which the record ascribes to him has its counterpart in other verbalized cases which have been here described, and would similarly operate against favorable accomplishment in dealing with numbers or with things Again, "There is no doubt that a rebellion against any form of constraint in his thoughts is one of the strongest traits in this boy's personality" Indeed, it ramifies far outside the verbal and quantitative fields, while nothing resembling it is recorded anywhere else in the family

Athletic interests are minimal as might be surmised Under pressure he did take up a minor competitive sport which might have afforded a good outlet for aggressions; at any rate he was quite successful in it and perhaps more interested than he liked to admit. Fantasy life is very active, his command of language together with his intelligence combined to give the record a detailed and closely analyzed account of this process Undoubtedly it had played an outstanding rôle in his adjustment to date, without apparent damage to his capacity for adjustment of a more realistic sort.

Initial impressions on different members of the Study staff are subsumed in such terms as (*a*) "eccentric," (*b*) "most abnormal seen in Study," (*c*) "most unusual we have had," (*d*) "cold and a bit unpredictable" (but, "in general quite friendly and cooperative" occurs in the same paragraph).

Physiologically a distinctive pneumogram was produced, markedly irregular with unusually frequent sighs, great restlessness. Body-build was highly ectomorphic with a minimum of the other components, and this man was a stereotype for the corresponding cerebrotonia. Conformably the Outstanding Traits assigned to this strongly marked personality were: Basic Personality Less Integrated, Dominance of Mood, Sensitive Affect, Self-Conscious Introspective, Ideational, Inhibited, Cultural, Verbal Facility, Shy, Asocial He also seemed rather on the plus side for Unstable Autonomic Functions, and was clearly minus for Just-So, Pragmatic, Physical Science Motivations, Social Science Motivations. The Soundness Class assigned was *C*

Test Observations

This case shows perhaps the greatest disjunction of *SAT* and *MAT* in the total series. *SAT* is 1.95σ high, *MAT* 2.46σ low. The alpha scores are less extreme (cf Case XIII, following), the verbal only .85σ high, number 1.34σ low. Vocabulary rates statistically between *SAT* and verbal alpha, 1.41σ high, but this is a function of low test ceiling and the actual score equals the best in the total series The alpha profile is marked by much better performance in opposites and mixed sentences than in directions and analogies, while the lowest number scores occur with computation and least common multiple

Both this and the previous case had a test of conventional "clerical aptitude" type, based on number-checking. Case XI was about local average, this one about .5σ high. While appearing to make but slight demands on "intelligence," the test is performed better by the local group than by a regular secretarial group, and XII's considerably higher *SAT* and verbal alpha ratings would lead one to expect this difference from XI.

The clear-cut overt traits in this man give a critical status to the Rorschach pattern Verbal Facility and Sensitive Affect would lead one to expect relative richness, which might be kept by the traits Inhibited and Shy from becoming overt. The response-number is 72σ low for this man's year group, and the richness rating is below average As mentioned elsewhere, there was an unusual amount of anatomy, pathology, and qualification Responses were heavily on the Whole side, and there was more than the usual tendency to white space There was no human movement response (two animal, no object movements), indeed no human response at all (seven animal plus animal detail). Form level was rather minus; there was somewhat increased responsiveness to the color cards. Two responses rated Popular, less than half the group average. The only outstanding departure from expectation here seems to be the rôles of color and movement, but in view of the historical status of the functions, this feature should hardly pass unnoticed

At this writing the manipulative functions observed appear in a better light than in previous discussion of the case By present standards, the easy block assembly problems average nearly 1 5σ high, the difficult .75σ high The easier performances particularly, would be consistent with the athletic skill already noted Motivations in any direction which a mechanical skill would connote, appeared absent

The handwriting analysis for this man has also been described, it is among those showing relative disagreement with the criterion, although it agreed on such salient points as "considerable repression, personal pride and sensitiveness, opposed by outward poise and affability." It is to be added however that a certain superciliousness then inferred from the script in disagreement with the criterion, seems now (post-war) to be more consistent with the overt picture

It is regrettable that, as in the previous case, no picture-story response is available for this man There is no nearer approach to it than afforded by certain free-answer vocabulary items. These were maximally rated for both XI and XII, as implicit in the Verbal Facility attribute, but are of negligible dynamic import.

A Strong vocational interest schedule was obtained for this man, and is discussed elsewhere High and low ratings in a scale of this sort rather represent differences of likelihood that a satisfactory place will be found somewhere within them On this basis the history would largely agree with the Strong scores except that these give too high a rating to certain professions concerned largely with quantitation

Later Record

This man made a notably good adjustment to his war service assignment The military career has been as colorful and demanding as any described in these presentations, concerned with informational services of the Army, with active work in occupied countries On the basis of much detail, the record comments

> It is surprising that this boy whom we thought of as rather culturally inclined should be so efficient in the face of danger, so practical minded and effective he has much more ability in Practical Organizing than we had conceived, and less motivation toward the ideational and cultural except as an avocational interest

It is not unlikely that he will remain in his present field of work, for which he has demonstrated peculiar fitness of equipment and temperament Much more somatotonia has developed, and overlays the cerebrotonia to a marked extent, e g., a compensation of the older shyness by a show of superciliousness, also the recession of earlier ideational interests

CASE XIII

This man is one of four sibs in fairly comfortable economic circumstances. The father's personality seems to have resembled the present individual more than is elsewhere the case in these presentations, in respect to a high ideational capacity associated with a love of action. The mother's concerns have been domestic, and social service. Of the sibs one may be of intellectual level similar to this case, and the general tendency is towards academic, artistic, and social rather than technological interests, although these latter have also been prominent in the antecedents The socio-economic status of the antecedents was not inferior to the present

As a small child he was apparently quite well adjusted and generally well liked. In early adolescence he was for several years in an exceptional environment where he was rejected and unhappy, but being taken out of this slowly regained his adjustment in secondary school. As with Case I, a conspicuous part in this readjustment was played by athletic accomplishment. A basic sociability frustrated during this period of growth has been reestablishing itself

Personal interests and hobbies have been heavily verbal Considerable difficulty with mathematics at all levels is described, and no branch of science was found which appealed to him. There is a hint that the lesser rigidity of verbal-ideational pursuits is attractive from this standpoint, as has appeared with other cases It is worth noting however, that there is *marked liking for* certain activities which involve the control of machinery, as in those who greatly enjoy driving a car without understanding its mechanism (sublimated aggression?)

On physiological observation here, he exerted himself in the treadmill run to one of the largest lactates observed (180), a basal metabolic rate was —1, substantially average.

In somatotype, mesomorphy predominated a little over endomorphy, with minimal ectomorphy. This differs from the personality pattern (psychotype) in that viscerotonic features are the least prominent, cerebrotonic the most. The Soundness Class assigned was *A*, consistent with the Outstanding Trait of Basic Personality Highly Integrated. The only other assignment of this sort was Selfconscious-Introspective, but the common invidious connotation of these terms does not attach, on the contrary, the record comments on unusually good personal and social insights which had been achieved. In the present trait series, he would also be positively rated for Unstable Autonomic Functions, Ideational, Cultural, Sociable, Inhibited, Human Values; and negatively as to Physical Science Motivations, Social Science Motivations and Pragmatic.

Test Observations

This man gave an *SAT* $.77\sigma$ above local mean, *MAT* -1.33σ. It is to be noted that in this group the *MAT* is uniformly lower than the number alpha, with reference to their respective norms. Almost certainly *MAT* is a more cultural function than number alpha. The result expresses an attitudinally negative reaction to the quantitative function, over and above aptitudes therefor, which in this case and the following appear little if at all reduced.

The verbal alpha score in this case is the same as Case I's, approximately 1.2σ high for the local norms, the number alpha is practically at par. The subtest profiles have no consistent tendency, in the verbal series analogies is highest ($+1.37\sigma$), directions lowest ($+.19\sigma$), in the number series the best is highest common factor ($+.60\sigma$), the lowest is number completion ($-.93\sigma$). Among these eight cases (I-IV, XI-XIV) selected for accomplishment in the verbal area, the present one is distinctive in its modest vocabulary rating, practically par for the local norms. The data afford no explanation of this, his academic field and his reading activities have been of a sort to tend towards one of the highest vocabulary ratings in the Study group. No appeal can be had to haste, the time taken for the test was just average. *So far as can be judged from the choice of words in projec-*

tive tests, this is not a failure of vocabulary technique, but represents a really smaller "active vocabulary" than one would associate with the rest of the verbal accomplishments.

On the projective side, the Rorschach Response Number is slightly over 5σ high for the Study year-group, and reaction times are short The pattern somewhat overweights details, and color over movement, two each of *FC* and *CF*, one *C* The form level is slightly better than average, the animal-human ratio is again average, but there is some overweighting of the "object" category The "unclassified" responses are relatively few in number, and the "Populars" fewer than one might expect. It is a healthy pattern enough, but less rich than might be looked for in one with a verbalist classification

Picture-story response, while simply phrased, is at a higher level of imaginative richness than represented in the Rorschach response. In contrast to a generally energetic bearing, as recorded by various examiners, the dominant theme is passive and reflective. The handwriting account is characterized as "very good except for energy" The high level of this quality was apparently misconceived in such phrases as "asthenic physical constitution" and "not energetic" The positive social characteristics however, and the general direction of activities were well picked up

The block assembly work was better done than to be expected in one claiming little aptitude in such matters (cf Case I) There recurs the suspicion that negative attitudes rather than aptitudes have been involved, though this function would need to be explored considerably further to be made the basis of a clinical evaluation on this point

Later Record

This man's academic performance was somewhat above average, consistent with rather superior abilities distributed also over a wide extra-curricular range Lack of scientific motivation or abilities was little, if at all, reflected in course grades Graduating normally, he was commissioned in the armed services, in the course of which he was considerably exposed to war danger, and supported an experience of special personal tragedy. Since separation professional training has been taken up, and a very mature and satisfactory level of adjustment is generally indicated

CASE XIV

This man is the oldest of three children, in a family rather better situated economically than any of the previous three cases. The father's field is again scientific with some professional distinction, his avocational interests are not particularly verbal. The mother appears more social-minded, also with artistic interests. Both are rich personalities who could have a psychometric pattern similar to this case, but there is no positive evidence for this. Antecedents have achieved distinction along technological, artistic, and political rather than literary lines. Personalities in the sibs are described quite differently from the present case. On the one hand more social and somatic, on the other less social and more technological. It is prima facie unlikely that their intellectual functions would test in a manner resembling this case.

It is remarked that he talked at an especially early age, but the early schooling recounts no such disjunctions as form the basis for the present selection. He showed very good all-round academic performance. There was little athletic participation, but this seems to have been no social liability, he has always been well accepted in his own age group. Since coming to the local environment a very satisfactory social adjustment has developed. Little if anything is recorded in respect to other interests, reading, sports, etc. Academic and social functions appeared adequate to have filled his life.

Under these circumstances it is not surprising that his physiological endurance was moderate, in a treadmill run of slightly over three minutes only, he built up the fairly high lactate of 150. It was observed that this case showed marked physiological contrast to another case who is on the roster of psychometric antitheses to this one ("as heavily verbal as *X* is mathematical"). Anthropologically, a relatively matured body-build is mentioned. The somatotype is fairly balanced, showing some departure from the personality organization. The latter presents cerebrotonic components in the lead with viscerotonia represented chiefly by the moderate sociophilia, and somatotonia by good support of stress and pain.

The Soundness Class assigned is *A*, with the Outstanding Traits of Unstable Autonomic Functions, Basic Personality Highly Integrated, Self-Driving, Inhibited and Pragmatic. In a lesser degree, other characteristics would be denoted by the present terms Sociable, Cultural, Creative-Intuitive and Just-So. Practical Organizing and Social Science Motivations might have been ranged on the minus side.

It may be noted that Cases XI and XII of the present were also rated Verbal Facility, but XIII and XIV are not. The attribute so denoted does not appear more than average in either, at least so far as oral expression is concerned. It might be assigned to the present case on the basis of written expression.

Test Observations

Unlike the other three cases in the series, the disjunction in this case is wholly in terms of verbal excess and not of quantitative deficiency; the latter functions test close to local average *SAT* is just under XII's, being 1 87σ high, and *MAT* but 24σ low, as compared with XII's 2 46σ deficiency. In alpha this man has the largest excess of the four, 1 45σ high, denoting a practically perfect score, with two tests completed ahead of time limits The subtest profile is thus of little distinction, though the completion of the analogies items without error in 5/6 of the alloted time is a record performance for this high level function The number alpha, like *MAT*, is substantially at local average and there is notable strength in the reasoning and series completion subtests. It is thus a comparatively "masculine" profile Vocabulary rates between the high performance of XI and XII and the average one of XIII

Among the projective functions the Rorschach pattern is distinctive for emphasis on detail and on the Form category, which accounts for about 90 per cent of the responses The responses are about ½σ more numerous than any of his year group, but rate only an average richness, there being a special deficiency in movement and organization response The Human category is much better developed than usual, being nearly up to the Animal in frequency, but the white space category was comparable to XII's. There was distinctive absence of the irregular responses of the landscape-plant-myth-map varieties Initial reaction times were fast Picture-Story response embodies little action, but a good deal of close reasoning and deduction about the situation concerned The dominant theme if understood as identification is one of frustration, if as projection, one of human sympathy

The handwriting account is psychiatrically labelled "very good." There is only one disagreement, with a handwriting characterization of "self-centered and undeliberately selfish", which is of interest in connection with the above picture-story response This may have been an over-stressing of the Pragmatic feature of the trait assignments, but this Pragmatic feature was well picked up in the handwriting report The moderate Just-So-ness was also picked up, and the social traits appear to have been very well described

The only other test function to be mentioned is the manipulative, which was well above local average, for both easy (dexterity, 1.27σ high) and difficult (insight, 53σ high) items As elsewhere in the material such abilities had been little reflected in previous interests

Later Record

The academic performance of this man is high, comparable to that of Case III, so far as grades are concerned In this case however, the specialization is not verbal but scientific and as high grades are earned in the scientific courses as in the verbal. Psychometrically, III and XIV were close together on the verbal side, while on the quantitative a distinct advantage lay with III In the present XIV there were motivations (cf the comparative Outstanding Traits) which offset the disparity, and did not so operate in III

This man's participation in the armed services was concerned with his field of specialization and involved no overseas service Assignments were satisfactorily carried out, and the general adjustment to them was rated Excellent (11, p 220). No reason appears why his development, professional and personal, should not continue at the level indicated in accomplishment hitherto

COMPARISONS, DISCUSSION

The genetics of the attributes here considered, and the relation of these attributes to the rest of the personality, provide a framework for further consideration of these cases How far is it possible to assess, in the convenient terms proposed by Stanley Cobb (2, pp 228-230) the rôles of genogenic and psychogenic factors in these attributes? The present sources of information are, (*a*) what is available from the family history, and (*b*) certain internal evidence of the test performances themselves. Outside of the parentage, the evidence from the antecedents is neutral, evidence for disjunctions of this sort is negligible, but the information is hardly so complete as to be admissible as evidence that they were absent As regards parents, those of XI are either neutral or negative towards the disjunction observed. In XII the parental evidence is certainly negative in this respect, this individual would be strongly repelled by and little apt for the career type of either parent In XIII there is much temperamental resemblance to the father, and fair probability of a psychometric one must be conceded, much the same could also be said of XIV Save in the case of XII the the evidence on mothers is very insufficient It is well known that women tend comparatively towards verbal and away from most quantitative abilities in tests, for which cultural factors can be held only partly accountable, but these would operate similarly for all cases The sibship tended to resemblance in Cases XI and XIII, differed distinctly in Case XII, in Case XIV one resembled and another greatly differed in the respects concerned. There is no evidence of differential environments to account for these findings, but it must be remembered that this evidence is narrative and not psychometric in character.

Considering that each of these cases had superior all-round educational opportunities, there is ground for supposing that failure of such an ability to develop, as for example, the quantitative in Case XII, is a matter in which native, genogenic capacities and attitudes share at least equally with factors of psychogenesis and conditioning. At this point it is impossible to account for these disjunctions even mainly on the basis of environmental inequalities. And though parental resemblances occur, the individual variations in the sibs of these men do not strengthen the case either for environment or for direct inheritance. A considerable genogenic rôle is indicated, but one subject to large variation from the parental *soma*. Case XII indeed is a veritable mutant, and not in psychometrics alone.

Evidence intrinsic to the tests is involved with certain assumptions as to their own native or nurtural determination. All tests have both kinds of determinants but some are more culturally loaded than others. The vocabulary range tests are the most culturally loaded of all here considered. The *SAT/MAT* group are somewhat more loaded than those of the alpha type. Given the reasonably equal educational opportunities here present, it can still be argued on these assumptions that differences in *SAT* or in vocabulary, are due mostly to native differences in capacity to absorb these opportunities. The difficulty with this line of argument is its neglect of motivation. Without adequate motivation, cultural opportunity will not interact with native capacity. For such a reason one may see as in Case V a fairly high verbal alpha score associated with a sub-marginal vocabulary range. Or one may see in a case outside the present series and marked by relatively strong motivations (7, participant *D*) a marginal alpha performance with a vocabulary score up towards average grade and a highly developed Rorschach response. The critical tests therefore are those which are least culturally loaded; but not because of the cultural differences themselves, which are of little importance in these cases, but because these cultural factors allow differences of motivation to get in more of their work. Immediate differences of motivation, i.e., of cooperativeness in the tests themselves, can here be discounted. Among the three tests most directly concerned, this environmental factor is apparently smallest in the alpha series used. It does not serve as well as one could wish and has since been improved in this direction, but the more the verbal-quantitative disjunctions shown by it, approach those of the relatively cultural *SAT/MAT*, the greater the evidence for the operation of native factors in these disjunctions of verbal and quantitative performance. What rôles one should at this point assign to ability and motivation seems a very difficult matter Ultimately, motivation is a function of all ability, "none so blind as those who will not see"

Examining the present cases from this standpoint, one finds that the sigma differences between *SAT* and *MAT* are uniformly about twice the sigma differences between verbal and number forms of the alpha The meaning of this is modified by the relatively low "ceiling" of the alpha, but in principle, the excess difference in *SAT/MAT* represents the influence of culture plus long-standing motivation, superposed on the more native differences (and immediate motivations) represented in alpha Back of the lessened exposure to quantitative training that undoubtedly contributes to such extremes as shown in XI and XII, lies the negative motivation towards functions of this type explicit in the history It is recognized that negative motivations of this sort are subject to conditioning, as by unfortunate teacher contacts, but the histories give scant evidence of this

Among these cases it is likely that the vocabulary range score can be used as further criterion of verbalistic motivations, though the test instrument is again open to improvement for this special purpose These data are at least consistent with what we know of the personalities as a whole XI and XII, who are temperamentally as well as psychometrically verbalists, have the larger vocabulary scores, both absolutely and in relation to alpha and *SAT* In XIII and XIV the verbal test superiority is there, but verbal functions play no such substantial part in the personality adjustments. In XIII there is, despite the high *SAT* and alpha, actually no vocabulary excess over the group average. In XIV the vocabulary excess over average is considerable, but is barely half that of alpha and *SAT*, and it will be recalled that the career motivations in this case are scientific

It is unlikely therefore, that it will ever be possible to make effective generalizations about the psychometric type of verbalism in its relation to personality type XI and XII stand out against XIII and XIV somewhat as do III and IV against I and II, especially II In their social adjustment (cf Cattell 1) XI was at least on the outgoing side, XII had the technique of sociality without its sentiment (there should have been a Bernreuter "self-sufficiency" score on this man); XIII seemed on his way to an "outstanding" sociality after episodes of frustration XIV had a good record of group-acceptance, but was apparently less dependent on social contacts than either XI or XIII, *a fortiori*, XII.

XII's verbalism shared the cerebrotonia that dominated his personality at the time of study, XI's was a blend of the other two components. In

XIII and XIV the attribute was hardly distinctive from this standpoint, they had high scores in verbal functions, but these functions did not play in their personalities the integral parts that they did in Cases XI and XII.

This is in accord with the assignment of the trait Verbal Facility to Cases XI and XII, but not to XIII and XIV. XII is the only one of these to have been also rated Sensitive Affect In view of the present selections by psychometric criteria, and those of Cases I-IV by (psychiatrically) assigned traits, there are relationships that seem worth pointing out XI has stood somewhere between I and III, though with not quite their intellectual potential, this rather than any lack in personality integrations might have limited him for the special combat rôle sustained by Case I XII has been definitely closer to III than to the others, but modified by the distinctive asociality that preserves his special place XIII and XIV have been closest to II Similarly rated in Basic Personality strength, XIV's assets derive from a somewhat higher intellectual alertness plus drive and practicality, while II's assets are served by a superior "Vital Affect," sociality and intellectual creativity. The qualities of XIII do not seem to have stood out at the time of special study, and his case, like that of XII, tends to point up the emerging and basic question of how suited this special age of observation (terminal adolescence, second year college) may be for valid estimate of subsequent accomplishment. It is pleasing to note that this accomplishment was generally underestimated The special stresses of growth as well as education to which a group like this is subjected at such a time, add to the difficulties imposed by still fragmentary knowledge. Only through the following of material like this through adult years may the latter of these obstacles be mitigated, and the former assessed.

Cases XI and XII might have, indeed XII probably would have, been called "verbalists" in the old invidious sense It has been remarked that their distinguishing feature is quantitative deficiency rather than verbal excess There is a strong suggestion that the invidious connotations of verbalism are grounded not so much in an overdevelopment of the verbal as in an underdevelopment of certain features denoted by the quantitative. The demand for "semantic elasticity" which has been a recurring theme in this connection is obviously met by verbal means rather than quantitative In these particular cases the demand has been justified psychometrically, and it probably could be justified philosophically. The invidious connotations arise when there comes a dependency on, rather than appreciation of, this semantic elasticity and a disinclination amounting to incapacity for precision in thinking For case-material of this less favorable sort one looks to the psychiatric clinic rather than to a group selected after the present fashion. A generation ago, these developments indeed assumed in the mind of a European scholar, the proportions of a nosologic entity worthy of a special treatise (3). In contemporary terms this is represented by the Rorschach conception of "form level." This and other Rorschach categories sometimes make convenient if oversimplified labels for personality types. As has been seen, the verbalist is far from necessarily an *F* minus personality, but the *F* minus personality has special impulsions to become a verbalist.[1]

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[1] Poe had intuitively reached a very similar point: " . . . and the remote source of his defeat lies in the supposition that the Minister is a fool, because he has acquired renown as a poet. All fools are poets; this the Prefect feels, and he is merely guilty of a *non distributio medii* in thence inferring that all poets are fools." *The Purloined Letter*.

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INDETERMINATE NUMBER CONCEPTS I. CLASSIFICATION AND RELATION TO DETERMINATE NUMBERS*

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A. DEFINITIONS

1. *Concepts in General*

Viewed objectively, a concept is an acquired response of an organism. It is variously defined as one which is made to characteristics or elements, or to the pattern, organization, or configuration common to discrete situations which, in their absolute or unique existence, may be highly variable (6, 14, 17, 18, 29).[1] Its development presupposes an organism which is capable of abstracting generic features from diverse or repetitive situations. The conceptual capacity of an organism is ascertained by establishing a controlled learning series in which the correct response must be crucially conditioned to those aspects that are *typical* of the different things, events, or circumstances. The degree of generalization of the concept may be determined by noting the extent to which the response is correctly made to stimulus situations increasingly divergent from those of the original learning conditions.

Concept formation requires certain organismic potentialities and the environmental opportunities for their realization. The establishment of a concept of triangularity, for example, is possible only for organisms capable of form discrimination and of the abstraction of 3-sidedness or *triangleness* from all the diversity of absolute sizes of triangles and of intra-angular magnitudes. Obviously, if the environment does not confront the organism with such geometric situations nor elicit an orientation with respect to them, the concept will not be developed.

In a sense, the established and highly developed concept may become an ideal object, event, situation, etc., against which specific objects or events or situations are matched for correspondence. Much of human conceptual behavior is, perhaps, a subjective matching process whose end product is a classification of things or of successions of events.

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[1] Others, such as Heidbreder (12), hold that the concept is a logical construct "transferable from situation to situation and communicable from person to person" but that it "refers to no reaction of the organism."

There are degrees or levels in the evolution of a given concept. Thus the response to common abstracted features may be effected on a non-verbal level or it may receive symbolic expression in a word and constitute a *term* (29).

Frequently, if not usually, the ideal object or concept is neither well-defined nor admitting of unambiguous verbalization. The so-called "concrete" nouns illustrate this lack of definiteness or determinateness in concepts just as well as do the so-called "abstract" nouns.

Thus, on first query, the term *chair*, or the concept of *chairness*, may be defined as "something to sit on." But then this is immediately rejected subsequent to the question, "Are all things to sit on, chairs?" This, in turn, may be followed by the redefinition, "A chair is something to sit on which has four legs." This, too, is seen to be inadequate when one inquires whether all things, on which we may sit and which have four legs, are chairs (e.g., riding or saddle horses). Or, to add further to the uncertainty and confusion, are there objects termed *chairs*, which do not have four legs? Ontogenetically, the *use* characteristic (something-to-sit-on) is one of the important criteria of *chairness*. It does not, as has just been demonstrated, actually differentiate chairs and non-chairs. Even when limited to the inanimate, one must rely upon construction, form, and size features to distinguish chairs from stools, benches, davenports, and so on.

This superficial exploration reveals the complexity of abstraction among concepts represented by "concrete" nouns. In every day speech or communication the words which we employ do not inform us of the degrees of conceptualization which underlie the symbolic terms. The age distance between acceptable definitions of "concrete" and "abstract" words in the Stanford Revision of the Binet Test (25) may be increased in part because of a great tolerance for partial, non-rigorous, or inexact definitions of the former.

2. *Number Concepts*

The ability to discriminate between unity and plurality is of subhuman and subverbal origin, and may, perhaps, be the fundamental base[2] from which

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[2] It is, of course, possible to regard motivation as more fundamental than discrimination in producing number concepts. McLellan and Dewey (13), in a philosophical approach to the origin of number, see such concepts as arising because things do not exist in unlimited amounts. Because things are limited man measures in order to conserve energy. Hence "numerical values" arise from a process of measurement. "Quantitative ideas" come from "the conscious adjusting of means to end . . . ." Thus

"Quantity means the *valuation* of a thing with reference to some end, what is all number concepts evolve. The organism must be able to react to the pattern difference between one and two or more objects in the experiential field—to the discrete *numerical* relations and not to the mere spatial organization of the several things or objects. The actual nature or limits of number concepts in subhuman forms do not appear to have received much systematic or controlled study save possibly among birds. Comparative psychology, as summarized by Maier and Schneirla (14), and by Munn (17), offers evidence of the ability of various organisms, other than man, to establish concepts of form, size, spatial relations, etc. These references review no research upon number discriminations. Anecdotalisms regarding number concepts in animals are related by Dantzig (7), and there are beginnings of an experimental literature in which 3 is reported to be the number limit attainable by the macaque monkey (8, 26, 27, 28) and, when geometric figure and position are controlled, limits between 2 and 6 among birds (2, 9, 15, 19, 21). One investigator (2) reports an ability to discriminate different numbers of objects analogous to that of man in situations precluding actual counting. That is, the dove is capable of perceiving the difference between two simultaneously displayed groups of objects up to the limits of 6 5. But doves and other birds such as Leghorn cocks, jackdaws, and parrots can also be trained to pick out a definite number of objects from a group of objects. Likewise they can discriminate a definite number presented in temporal succession. These researches do not, of course, establish the presence of "counting" behavior nor of the developed number concept as found in the human adult.

The symbolic differentiation between unity and plurality is expressed in many languages by specific inflection of some of the parts of speech. Thus, in the declension of nouns the singular termination may differ from the plural: Buch(s.), Bucher(pl.), livre(s.), livres(pl.), libro(s.), libros (pl.); libro(s.), libri(pl.); book(s), books(pl.). The Romance languages, with the exception of the Italian, and English express plurals generally by a terminal added *s*. There are, of course, exceptions to this general rule, and in the last-mentioned language there are irregular endings in *en*: child(s.), children(pl.); ox(s.), oxen(pl.), in *ies*: filly(s.), fillies(pl.), hickory(s.), hickories(pl.), in *oes*: mango(s.), mangoes(pl.), tomato(s), tomatoes(pl.). Or there is internal flection: mouse(s.), mice(pl.), goose(s.), geese(pl.).

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its *worth*, its *effectiveness*, compared with *other possible means*. These two conceptions—(*a*) the origin of quantitative ideas in the process of valuation (measuring) and (*b*) the dependence of valuation upon the adjusting of means to end (i e, ultimately upon activity) are the beginning of all conceptions of quantity and number, and the sound basis of all dealing with them" (p 41)

In Italian, the inflection for plurals is regular for the most part but does depend upon the gender of the noun thus giving rise to *e* for the plural of nouns ending in *a*, and to *i* for nouns ending in *o* or *e*

Terminal flection frequently distinguishes the German plurals from the German singulars of the same gender, but there are nouns which like *Fenster* undergo no change except in the genitive singular and in the dative plural, others have only the nominative singular(Knabe) differentiated, some such as *Apfel* differentiate by terminal flection only in the genitive singular and dative plural but carry internal flection in all plurals Indeed it is characteristic of the German language to utilize internal vowel change, independently or with terminal flection, to express number.

Similarly, pronouns, either by inflection or other differentiation, may express simple singular-plural distinctions. Thus in English· I, me(1st person sing)—we, us(1st person pl.), thou, thee(2nd person sing)—ye(2nd person pl.), he, him, she, her, it(3rd person sing)—they, them(3rd person pl). The present use of *you* carries no number discrimination

These distinctions between unity and plurality are further reinforced in most western European languages by the inflection of modifiers such as adjectives and articles Thus, in the Romance languages, terminal flection distinguishes the plural of the definite article from the singular as follows: le, la(s.)—les(pl.), el, la(s.)—los, las(pl), il, la(s)—i, le(pl). In the German language the determination of number from the definite article is uncertain because the forms *der*, *den*, and *die* may be either singular or plural according to the gender and case of the noun Only the forms *das*, *des*, and *dem* are used exclusively to indicate the singular The English *the* cannot express number but the indefinite article (*a*, *an*) is, of course, precise in its number meaning Adjectives, in general, are inflected like the articles to indicate number in the Romance languages, and again offer no clear-cut differentiation in the German Except for comparison, adjectival inflection does not occur in English.

Verb inflections may also give the cue to number These are quite complete in German and in the Romance languages (at least as written), whereas English verbs are relatively uninflected. In these, only the third person singular is regularly differentiated by the termination *s*(he *works*) In the verb *to be*, the first and third person singular, present tense, are expressed by *am* and *is*, respectively.

Cursory inspection of the western European languages will reveal that the inflections of nouns, modifiers, and verbs simply separate the *more-than-one* from *one* of a *kind*, but that they offer no further differentiation without the addition of either the relatively indefinite, or the more specific, numerically limiting modifiers In other words, unity is determinate whereas simple plurality is indeterminate in number.

Some languages carry the number flection a step further Ancient Greek and Hebrew, according to Smith and Ginsburg (24), and Sanskrit, according to Bodmer (3), have two terminations for noun plurals—the one signifying *two* of a kind and the other, *more-than-two* Bodmer states that this dual flection occurred also in pronouns, being widespread in the earlier representatives of different language families It was found in English in the times of Alfred the Great but now survives in Icelandic, Lithuanian dialects, the Amharic of Abyssinia, etc Dual personal flection of the verb, as well, occurred in Sanskrit, early Greek and Gothic

Bodmer (3) hypothesizes that the stressing of *two* by special language flection may originate because of the stimulation afforded by family structure or by the bi-symmetrical representation of organs:

> Separate dual and plural forms of the pronoun may go back to a time when many human beings lived in scattered and isolated households made up of *two* adults and their progeny At this primitive level of culture the stock in trade of words is small, and a relatively considerable proportion would refer to things which go in pairs, e g, *horns, eyes, ears, hands, feet, arms, legs, breasts* If so the distinction may have infected other parts of speech by analogical extension (p. 93)

Bodmer regards most number inflections as superfluous or redundant For example, in *two cows were in the pasture* the plural is clearly expressed twice: by two, and by the *s* of *cows,* and less certainly by *were* For true language simplification he would represent number either *determinately* by *two, three,* etc., by *one* or the article *a,* or *indeterminately* by modifiers *few, several, many,* etc Hence he affirms that "it is wasteful to tack on a plural mark when the statement as a whole, or the presence of a qualifier such as *all, many, several, five,* makes clear that the word stands for more than one of kind" (p 495).

This elementary review of language inflections has demonstrated two types of number concepts the determinate or definitely limited number, and the indeterminate number whose limits are not well-defined.

In using symbols or number names to express determinate numbers, human beings are said to be *counting* and *ordering* all of the objects of a collection. Barring errors, those persons who have acquired and share a sufficiently developed number system will arrive at the same result. Thence comes that specificity and universality of response which distinguishes number from all other human concepts. Their unambiguity makes them the best instruments or tools for expression and for communication which man has devised, and it is therefore inevitable that they should, as Weiss (30) and Dantzig (7) phrase it, constitute the language of science

Determinate numbers fall into two classifications cardinal numbers, to express the totality of a collection or group, and ordinal, to state the rank or position of an individual within a group

The word-symbols which express indeterminate number concepts do not rest upon a serial counting process, but rather upon the basis of estimate, which will necessarily fluctuate from person to person. The boundaries or limits of the ideal group constituting the indeterminate number concept are hazy and indistinct. There are limits, but these are not precisely fixed and hence there can be only imperfect matching or correspondence. Furthermore there is little evidence of a well-organized or extended ordinal system in indeterminate numbers. Naturally, comparison of some of the indeterminate modifiers may express number differences *within the concept*, such as in *few, fewer, fewest*, or in *many, more, most*, etc.

It is the aim of this paper to catalog or to list the principal categories of indeterminate number words, to show their interrelations, to discover their relation to determinate number concepts during the course of anthropological or human cultural history, and to evaluate their continuing rôle in human affairs

B. CLASSIFICATIONS

The most comprehensive compilation of the names of indeterminate number concepts and their synonyms is probably that given in Mawson's revision of *Roget's International Thesaurus of English Words and Phrases* (16). Starting from the basic concept of *number*, this reference work makes a twofold division into determinate and indeterminate numbers. Within the first are those terms pertaining to the cardinal and to the ordinal numbers. Within the second are portrayed the diversity and the interrelation of terms referring to number concepts which are not sharply defined or even distinct from one another, and which are not always constant from situation to situation, nor even from individual to individual.

The Thesaurus employs the following classification of indeterminate numbers: (*a*) plurality—more than one, (*b*) fraction—less than one, (*c*) zero, (*d*) multitude, (*e*) fewness, (*f*) repetition, (*g*) infinity

A careful examination of these concepts will reveal that the term *indeterminate*, as applying to number, should not be interpreted to mean numbers which have *no* limits Words such as *several, few, many*, etc, obviously have as their lower limit a number greater than *one*. They *approach* one as a limit, either to a *range* whose other limit is more flexible in locus or which admits of infinite or limitless applications from its "zero" point. Perhaps this latter statement should be somewhat qualified by recognition of the fact that indeterminate number concepts do not become as completely abstracted from things as do determinate numbers. Hence some of the indeterminate numbers may reach their terminal limit of application with exhaustion of the finite number of things in a class.

Similarly, the indeterminate number concepts of fraction, or less than unity, must have unity as one of their limits. Such terms are illustrated by *fraction of, part, bit, some*. The last mentioned, however, has a dual rôle because it may apply to less than one, as in "some of the apple," or it may refer to more than one, as in "some apples."

From the psychological point of view it is not obvious why the Thesaurus should include *zero* among indeterminate numbers. It would seem that the complete lack or absence of things, or objects of a class, would be just as determinate or definite a fact as is a determinate cardinal number. Zero should be a point from which as origin one moves first into the fractional or less than unity and then, arriving at unity, passes on to plurality.

Further scrutiny of these indeterminate numbers discloses that those relating to plurality, or more than one, may be classified according to whether their range (coverage) is in the near vicinity or neighborhood of unity (the concept of *scarcity* or *fewness*) or whether they start at a considerable remove from unity and have their upper limit at a still greater distance, or that they have no upper limit within finite things. Among the first are *paucity, scarcity, few, hardly* or *scarcely any*, etc. Among the second are *multitude, host, many, lot, etc.*

Still other indeterminate number names may be employed when referring to *events* or *situations* which involve *repetition*. These include: *repetition, often, again, over and over, seldom, frequently, occasionally*, etc. They apply to *successions* of events.

On occasion, too, even determinate number words may be pressed into service to give the impression of the indeterminateness of estimate, as when one says *hundreds, thousands, millions, a thousand-and-one*, or with limits more sharply set—*some ten or a dozen, half a dozen*, or with range still more circumscribed in terms of determinate numbers—*to be counted on the fingers of one hand, to be counted on one's fingers*. Again, the popular notion of infinity—something beyond the power or patience of humans to accomplish—is expressed by reference to collections with actual finite limits ranging through. *numerous as the hairs on the head, plenty as blackberries,* or *numerous as the sands on the seashore,* etc

But, if popular language borrows exact numerical terms from mathematics and blurs or blunts them to represent the indefinite or indeterminate, it is also evident that the mathematician has found at least one of the indeterminate concepts necessary to his theory, namely, that of infinity in the sense of no terminal limit to the serial progression of consecutive numbers, nor to the division of unity If the concept of zero be indeed indeterminate then there, also, is another instance of the utility of such concepts to the mathematician

Other bases for the classification of indeterminate number concepts exist but the shifts in emphasis are of minor rather than fundamental importance Thus one may separate such concepts into two main groups (*a*) those which deal with spatially coexistent things or objects, and (*b*) those which refer to the repetition of events in a temporal succession Naturally, some individual terms are applicable within either category, whereas others are limited to one, e g , *many* and *lot* to the first and *frequently, occasionally, often,* etc , to the second group. But the indeterminate temporal repetition may also be expressed by *time* or *times* as modified by *few, some, many,* etc , or *ever* with *scarcely* or *hardly* Or, again, one may set up indeterminate number categories according to whether the terms refer to fractions (less than unity) or to plurality (the indeterminate more-than-one)

Finally, to emphasize the difference between determinate and indeterminate numbers, it should be stressed that in the former the concepts have come to be fully abstracted from all objects, things, and events (even though we continue to speak of numbers of less than 10 as the *digits*) so that they apply regardless of the nature of the discrete things which are being enumerated, whether these be pennies, trees, or baboons. It is, on the contrary, by no means certain that indeterminate number concepts are completely abstracted and possess uniform value when applied to collections of *different* things or to *different* successions of repetitive events Hence if one eats only once per week and has a toothache likewise once each week the indeterminate *often* would probably be appropriate to the frequency of the toothache but emphatically not to the frequency of meals.

In the absence of experimental data one may hazard the hypothesis that the use of indeterminate number concepts will vary according to the nature of one's experience even though the actual number of objects or the frequency of events remains the same in all the situations compared Therefore a rich man might not consider a hundred dollars a *lot of* money, but to a poor man such a sum would be a *lot of* money or *many* dollars in relation to his circumstances And, as previously stated, one meal each week, in relation to need and habit, would never be described as *often*, whereas a toothache with numerically the same incidence would probably be described, by most of the population, as occurring "often"

The situational, as well as the personal, variations in the use of indeterminate number terms highlight their extreme relativity and raise a question regarding their utility or their communicative function in human affairs

C THE RÔLE OF INDETERMINATE NUMBER CONCEPTS IN HUMAN CULTURAL HISTORY

1 *Data from Cultural Anthropology*

In their pursuit of the origin of number concepts the cultural anthropologists and the mathematical historians have amassed data seeming to demonstrate that among so-called primitive peoples the indeterminate number name is employed at the point where the determinate number series of the culture ends.

Smith (23), and Smith and Ginsburg (24) state that even after men started to be "civilized" there was a tendency to represent the larger numbers by varying indeterminate plurals equivalent to our collectives such as *herd* or *drove* of cattle, *flock* of sheep, *pack* of hounds, *school* of fish, *brood* of chickens, *swarm* of bees, and similar names more or less specific for groups or collections of particular things. The histories (1, 5, 7, 23, 24) of number concepts all agree that when the terminus of determinate number names is reached, among the so-called primitive tribes in different parts of the world, there is recourse to indeterminate expressions equivalent to *several, much, many*

According to Conant (5) there are no known tribes of human beings which do not have one or more words to express determinate number concepts There are, however, tribes which have number names up to and including *two* One, the Botocudos, stop at *one* as a definite number, with *two* represented by their word for *many* *Two* is the number name limit of the Puris and Watchandis. To express *three* the Puris give their equivalent of *many,* whereas the Watchandis express it by the combination *two, one* The Andamans and the Bushmen have *two* as their number name limit, the Veddas have the same and beyond that keep repeating, *"and one more"* Hence in *two*-limit number systems *more-than-two* is expressed by the indeterminate *many* or by combination as in the binary system of certain Australian and African primitives These attain *six* by composite numbers, anything beyond being termed "heap," according to Dantzig (7). However, the limitations in number names do not necessarily mark the limit of number concepts because some of these peoples utilize fingers, or fingers and toes, to denote larger numbers even though this is accomplished by matching since they have not arrived at the stage of serial finger counting. By these means a final limit of 20 may be reached.

In still other tribes the limit in number names is *three*, with the indeterminate *many* given to more than three, or with the larger number expressed as a composite. Among those employing the indeterminate number name, Conant (5) lists forest tribes in Brazil and various Australian primitives. Some of the latter use *many* for *four*, and *very many* for *five*. Among those employing composite numbers beyond *three* are the Campas of Peru with their words for *one* and *three*, *one* and *one* and *three*, etc., until they fall back upon *many* beyond *10*. Dantzig (7) is of the opinion that our European ancestors at some time must have had similar limits because

> Practically every European language bears traces of such early limitations. The English *thrice*, just like the Latin *ter*, has the double meaning thrice times and many. There is a plausible connection between the Latin *tres*, three, and *trans*, beyond; the same can be said regarding the French *très*, very and *trois*, three (p. 5).

If the culture pushes definite number names beyond *three*, it generally attains a quinary system, for the anthropological reports cite few instances of number names with *four* as the last number. One Australian tribe mentioned by Conant (5) does have such a limit, beyond which they say "great-great."

Quinary systems, similarly, may stop at *five* and thereafter use the indeterminate expression. At this point in the development of determinate number concepts, however, the use of the fingers and hand in serial counting becomes significant. Thus Dantzig (7) states that in many primitive languages the number *five* is expressed by the word for *hand*, and "the number-words up to four are identical with the names given to the four fingers." Quinary systems were widely distributed among the Malay cultures of the Pacific islands and among the Indian tribes of North and South America—the quinary-vigesimal being dominant in Central and South America, whereas many North American Indians possessed a decimal system.

But quinary systems, if they develop to any great extent, pass over into decimal or vigesimal systems. The decimal base, the world over, is demonstrated to be the most universal of number systems. It is believed that this is no accident but that it stems from the flexibility, convenience, and presence at all times, and in all situations, of the fingers as *counters* Here again, the hand has served man well in his manipulation of the universe!

Conant (5) states that the limits of counting among "savage races" may extend to 1,000 which, from philological evidence, is about the limit reached by the ancient Anglo-Saxons

The use, in primitive languages, of finger names for numerals demonstrates their identification with the most universal counters available to man, and also lays bare a stage in the process of the abstraction of number names. This incomplete abstraction of number concepts from specific objects is illustrated further by Aztec and Malay tongues of which Smith (23) says·

> The number names mean literally one stone, two stones, three stones, and so on, while the Niues of the Southern Pacific use "one fruit, two fruits, three fruits," and the Javans use "one grain, two grains, three grains," all these being relics of the concrete stage of counting When a Zulu wishes to express the number six, he says "taking the thumb" (*tatisitupa*), meaning that he has counted all the fingers of the left hand and has begun with the thumb of the right hand For seven he says "he pointed" (*u kombile*), meaning that he has reached the finger used in pointing (p 8)

A case of still more rudimentary abstraction is found, Dantzig (7) reports, in the Thimshian language of British Columbian Indians

> There we find seven distinct sets of number words one for flat objects and animals, one for round objects and time, one for counting men, one for long objects and trees, one for canoes; one for measures, one for counting when no definite object is referred to . (p 6)

In the earliest cultural beginnings, therefore, determinate number concepts were gradually becoming abstracted from concrete objects Dantzig (7) affirms "It is counting that consolidated the concrete and therefore hetero geneous notion of plurality, so characteristic of primitive man, into the *homogeneous abstract number concept,* which made mathematics possible" (p 6). By contrast, it would seem that indeterminate number concepts fluctuate according to the concrete things, or the specific events or situations rather than maintaining a constant relation to the absolute number of things involved.

In summary, it may be said that indeterminate numbers throughout the course of human cultural history have expressed what lies beyond the last number of the determinate series This indeterminateness is achieved by using the equivalent of *many,* or by employing the ultimate number name of the language as in *scores, hundreds, thousands,* and so on But indeterminate numbers are not merely extensions of a determinate number system. They have a concurrent existence which makes possible some number limitation when one estimates rather than counts.

2. *Data from Genetic Psychology*

From the preceding review of the development of number concepts has emerged the conclusion that once the limit of the determinate number system is reached in "primitive" tribes there is resort to indeterminate names to refer to plurality.

The question may now be raised whether "ontogeny repeats phylogeny." That is, does the child, developing in a culture possessing an extended number system, manifest stages in acquisition such that some actual number discrimination precedes number names and that thereafter there is at first mastery of only part of the determinate numbers and that beyond his *last* number he, too, is forced back upon his indeterminate? Comas (4), in summarizing Preyer's and Decroly's studies of children aged 18 and 14 months, respectively, states that children discriminate larger and smaller, more and less, and the absence of an object from a group before they can use and understand the terms *one, two, three,* etc. Furthermore when these are acquired the last determinate number, or other numbers, may be used to indicate many.[3]

In a culture characterized by well-established serial counting habits the child may be encouraged to learn the number names in rôte fashion. Such "counting," obviously, can have no numerical significance because it bears no relation to objects, and because it may be learned long before the child can actually discriminate numerical relations.

In addition to this training in oral responses the child hears adults using the number names in a great variety of situations. And parents even give specific personal reference by applying them to parts of the child's body, saying, "*one* mouth, *one* head, *one* nose; *two* eyes, *two* ears, *two* hands, etc., *five* fingers, *five* toes." Indeed, in the average home, the association of the counting response with actual objects is probably made when the parent says the numbers while touching each finger in turn.

In this manner the preschool child arrives at the stage of being able to give the number names while he counts off or points to different objects such as Tinker Toy sticks, marbles, blocks, etc. Grigsby (11) found the average terminal limits to be: 1.64 at 3 *CA*, 12.44 at 4 *CA*, 19.05 at 5 *CA*; and 26.5 at 6 *CA*. *There was no evidence that form, size, or color of objects* appreciably altered the counting response in these age groups. Hence it is argued that the child has established true number concepts. Other students of the problem, such as Terman and Merrill (25), require the child to select the number called for from a pile or group of objects containing more than the number requested. In this way, it is maintained, the child will demonstrate his true grasp of number concepts by critical responses rather than merely repeat the more mechanical, serial counting derived from rote learning.

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[3] A mesura que es van diferenciant de la impressió de grup, els conceptes dels primers números (1, 2, o més frequentment 2, 1) els noms dels altres es van usant successivament d'una manera arbitrària per indicar *molts* (un nen de 2 anys i 8 mesos observat per nosaltres diu *tres* sempre que una quantitat passa de dos) (pp. 419-420).

Of particular pertinence to this paper is Grigsby's (11) observation that when the younger preschool child reaches his limit in counting objects he may say "a whole lot," and that the older preschool child when asked to tell how many sticks are in the entire Tinker-Toy package says "a hundred" or "a thousand." This investigator views determinate numbers arising as follows:

> These terms represented a continuous quantity as definitely as the "whole lot" of younger children. It seems, then, that the young child perceives undifferentiated quantity which later becomes discontinuous at increasingly high levels with rise in mental and chronological ages. It was also evident that the child could repeat the number names before he attached to them the meaning of a designator or of abstract "manyness" (p. 156).
>
> The concept of number is in the beginning consciousness of continuous quantity which is differentiated at higher levels as chronological and mental age increase. The abstract concept of "manyness" which is applicable to all experience is the true number concept (p. 156).

Russell (20), too, holds that "the child's first concept of number is a *manyness* from which the quantity and serial aspects of number differentiate." The first differentiation is of *more* and *less*, and *many* refers to numbers beyond his power to count.

Writers like Grigsby (11) and Russell (20) seem to let their commitments to Gestalt theory lead them to a strained interpretation of *many*. According to them, this is an undifferentiated quantity for the child. But their researches do not actually prove a failure to discriminate discreteness beyond the limit of the child's number system. It may be doubted whether there is any great constancy or uniformity in the concept of "manyness," nor whether it is an undifferentiated quantity. It is instead probable that this concept varies from situation to situation and from person to person. "Manyness" is subsidiary to the larger concept of *plurality* (the more-than-one), and should no more be taken as the origin of number than "fewness," "severalness," etc. As we have seen, language indicates the basic number discrimination to be *one* and the *more-than-one* (plural).

Grigsby (11) also investigated partitive responses, or what from the angle of this paper have been termed the indeterminate fractions (the *less-than-one*), in preschool children. The children demonstrated their understanding of *part* and *some* by carrying out directions: (*a*) "Give me a part of the blocks"; (*b*) "Put some of them in the box", (*c*) "Put all the blocks in the box." Their comprehension was also tested by questions: (*a*) "Some of the blocks were red. What color were the blocks?" (*b*) "A part of the sand in the pile is wet. Is the sand in the pile wet?" (*c*) "A part of my apple tastes good. How does my apple taste?" No quantitative data upon the determinate number of blocks selected for *part* and *some* are given. The responses to the questions, in terms of correct answers, revealed decreasing difficulty in grasping partitive relations with increase in age of the children. The difficulty varied with the material—the blocks presenting the simplest and the apple the most difficult situation. From this the author concluded that

> it was more difficult to conceive of a part of a homogeneous substance like an apple than it was a mixed substance like sand, and still more difficult than to conceive of a part of a group of blocks (p. 159).

When children are confronted with discrete objects which exceed the scope of their number concepts or number names they may respond by giving their terminal or last number rather than by employing an indeterminate number name. A child, asked how many fingers he has, may reply "two" or "three" or perhaps run off a series like "two, three, seven, eleven" from the number names which he recalls from the serial counting of his elders.

According to Munn (17) the normative steps in the child's acquisition of determinate number concepts are: *two* at 4 *CA*, *three* at 5 *CA*, nine at 7 *CA*.

Giltay (10) selected for investigation children in 6-month *CA* groups ranging in age from 2 years, 6 months to 7 years, 6 months. Subjects of average intelligence were obtained by taking those whose *MA* deviated no more than one month from their *CA*. Acquisition of number concepts varying in range of numbers and degree of complexity within each concept were explored by different techniques. In the simplest of these the child was trained to always remove the cardboard cover from the top of a receptacle if it had the larger number of black squares (4 mm. sq.) regardless of the position or arrangement (five different patterns) of the squares. In the more difficult (for the child) experiments auditory stimuli (produced by tapping table with a pencil) of a given number but with varying or different intervals of separation had to be correctly discriminated if the child were to be rewarded by obtaining a piece of candy from a box on the table. The child's back was turned toward the table during the tapping.

The normative series obtained from these experiments indicates the range in age at which the given number concept appears from the simplest form to that of greatest complexity:

Concept of 1 is acquired and developed between 2 yrs., 6 mos. & 5 yrs.
Concept of 2 is acquired and developed between 3 yrs. & 5 yrs., 6 mos.
Concept of 3 is acquired and developed between 3 yrs., 6 mos. & 6 yrs.
Concept of 4 is acquired and developed between 4 yrs., 6 mos. & 6 yrs., 6 mos.
Concept of 5 acquired and developed between 5 yrs., 6 mos. & 6 yrs., 6 mos.
Concept of 6 is acquired and developed between 6 yrs. & 6 yrs., 6 mos.
Concept of 7-10 is acquired and developed after 6 yrs.

This review of man's development history has shown that indeterminate numbers bear the following relation to determinate numbers: whenever man comes to the end of his definite numbers, or finds it impossible or unnecessary to apply those which he does possess, he is, perforce, dependent upon indeterminate number concepts to express himself.

D. Persistence of Indeterminate Number Concepts—Utility and Shortcomings

There is, in the everyday intercommunications of human beings, a leeway, a wide latitude in the verbal responses which will reflect a mutual and a general understanding. It is unnecessary for us to count or to measure precisely in order to convey certain differences in numerical relations. In fact, in many instances, this would be impracticable or impossible in point of time. We can get along quite nicely in terms of the coarse and ready estimate embodied in indeterminate numbers. And we would find social life fearfully and unbearably cumbersome if we were always to quantify in determinate values our *few, several, some, many, often, seldom, occasionally,* etc.

But what can be said in extenuation of the use of indeterminate number names in situations where there is no direct personal contact which would make possible a correction of differences in meaning? In the early days when the daughter of the house learned to cook by apprenticeship to her mother it was possible for her to see by demonstration what constituted a "bit" of this, a "little" of that, and "some" of something else There was then no need to reformulate these indeterminates or to translate them into determinate *spoonfuls, cups,* etc, and so on When apprenticeship, with its constant checking and guidance, disappears as a form of education, and is replaced by a cookbook the terms used for recipes must be precisely stated in regard to the amounts of material or ingredients required, the sequence of activities, and the durations of the various processes In short, *whenever correct performance must depend upon a widespread dissemination of information the uniform or constant determinate numbers have replaced the uncertain and variable indeterminate numbers*

Even in ordinary social intercourse it is quite possible that this variability and lack of definiteness will give rise to misunderstanding and confusion. Perhaps the schools should devote real effort to the refinement or standardization of indeterminate number names so as to avoid application of a *scarcity* concept by one person and a *host* or *multitude* concept by another to the same numerical situation. Perhaps it might be possible to depersonalize somewhat the meaning or coverage of such words and thereby introduce more uniformity in their use.

Although indeterminate numbers are usually justifiable and sufficiently accurate for conversational purposes they are entirely out of place when employed in quasi-scientific attempts to judge human character or personality.

Inspection of personality and study habits inventories, discloses that they are heavily loaded with items whose *crucial* words are *frequency* terms. In other words, the number of times the behavior act occurs or has occurred is supposed to be significant Despite the importance obviously attached to this frequency it is stated in indeterminate words rather than in determinate numbers which would have the same meaning for all persons Hence the actual occurrences may be the same for two individuals but one may answer affirmatively and the other negatively because their meanings for indeterminate terms differ This presents the rather ludicrous spectacle of so called personality or character traits which do not actually rest upon differences of behavior but upon a difference in the interpretation of words Probably this is a factor contributing to the lack of validity of such devices

Simpson (22) investigated the meaning, to college students, of 20 indeterminate words and phrases commonly used to express differences in frequency The students rated each term abstractly, i.e., apart from any actual situations, by assigning per cent of times judged to represent each word Some median per cents and quartile differences are, respectively 78 and 20 for *often*, 20 and 22 for *sometimes*, 10 and 12 for *seldom*, 7 and 9 for *hardly ever*. From this demonstration of individual variability he concluded that indeterminate frequency words should be eliminated from questionnaires and that responders react instead to stated percentages

But variation in meaning is probably not confined to purely *individual* differences The meanings will also vary according to circumstances And, from what is known regarding self-ratings one would expect some persons to answer affirmatively in relation to high frequency of behavior items believed to redound to one's credit or to enhance one's social prestige, and to answer negatively to the high frequency of discreditable items even though the determinate frequencies were the same. Other individuals might reverse this: underrating the "good" and exaggerating the "bad" points

E. THE EMPIRICAL DETERMINATION AND STATISTICAL EXPRESSION OF INDETERMINATE NUMBER VALUES

The report by Simpson (22) is a valuable pioneer attempt to quantify some of the indeterminate number concepts and to caution against their use in work which purports to be scientific Unfortunately it furnishes no information regarding the reliability of the differences existing among the terms, and the investigation forced the reactors to judge the terms as divorced from any context Also, only one age group was sampled and hence there is no data regarding the ontogenetic steps in such concept formation

These and other aspects of the use of indeterminate numbers have long disturbed the present writer, and led eventually to the planning and execution of a research program, the results of which will appear in subsequent papers of this series

Specifically, this research attempts to explore the meaning of indeterminate number concepts in three different age groups by the following methods.

1. The selection by these age groups of the indeterminate number names which are appropriate to various known determinate number collections of different items.
2. The selection by these age groups of a definite number, from a group or collection of items, which will best express a given indeterminate number name
3. The recording in determinate numbers of what these age groups regard as the minima and maxima of the selected indeterminate number names, as associated with different things

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PHENOTYPE PATTERNS OF RACIAL REFERENCE AND OUTSTANDING PERSONALITY TRAITS*

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A. INTRODUCTION

The significance of phenotype patterns of racial reference was studied by the physical anthropologist of the Grant Study of Harvard University as part of a larger investigation dealing with the interrelationship of the morphological constitution and personality. An attempt was made to determine the extent to which these phenotype patterns were associated with certain outstanding personality traits in a group of 258 selected Harvard undergraduates, all participants in the Grant Study (8, 1, 2).

Since its establishment in 1938, the Grant Study has centered its investigations on the total personality of the normal young male adult, with the view toward fulfilling the need in our knowledge of the normal person. The approach has been clinical and it has been carried on cooperatively by persons trained in medicine, physiology, anthropology, psychology, psychiatry, and sociology. The subjects studied were Harvard undergraduates, who were first observed with few exceptions in their sophomore years. It must be indicated that they represented a selected group in several respects.[2] In brief, the Grant Study subjects were selected on the basis of good health, satisfactory academic status, and overtly good social adjustment. On intellectual grounds only those young men were eliminated from consideration as participants whose academic records were unsatisfactory in their freshman year or whose prospects for completion of the total academic requirements were not promising. They did not represent a random sample of the college population in intellectual capacity, academic attainments, past medical history, and social adjustment, but they were more or less representative of the college body at large with respect to socio-economic status, religious affiliation, and type of previous schooling.

For the purpose of this monograph attention has been directed to the

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[2] For detailed information relative to the nature of the group, selection of the subjects, methods of examination, and definition of normal, see (1).

classification of the subjects according to the dominant personality trait groupings. The account of the methods of interview, personality classification, and definitions have been published (1). It is important to note that all personality designations were independently made by the staff psychiatrists from the mass of interview material obtained from the subjects studied with no consideration of the morphological constitution The appearance of certain personality traits with considerable frequency made it desirable for the psychiatrists to group those subjects who had specific *outstanding* characteristics in common. Thus, for example, there appeared a shy group, an unstable autonomic functions group, a vital affect group, a sociable group, a self-conscious introspective group, etc The personality traits dealt with in this monograph are heavily weighted towards the aspect of life attitudes, intellectual functions, and motivations. This was the natural result of dealing with college students, selected "normal" individuals, and the particular orientation of the psychiatrists to the problem of "career choice" of the subjects.

The morphological data on which this investigation is based have been obtained by the physical anthropologist of the Grant Study, who has been mainly concerned with the variations in the physical structure and appearance of normal young men and their relationship to other characteristics of the individual. The methods of morphological description and classification utilized embraced a large series of anthropometric measurements, proportions, morphological observations, somatotype ratings, and an estimate of masculine component The classification of the subjects according to the phenotype patterns presently described were based on a limited number of anthropometric measurements and observations derived from this mass of basic morphological data.

B. Phenotype Patterns of Racial Reference

The racial classification of native born white Americans is at best a complex and tenuous business This is principally due to the character of modern population, being so highly mixed and consisting in the main of hybrid combinations with only small minorities clinging more or less closely to the physical types of the original parental stocks. The most satisfactory approach to this problem of racial classification is that employed by Hooton in his Harvard criminal survey and the Century of Progress data (3, 4, 5). This method involves the classification of individuals into types by multiple mechanical sortings on the basis of combinations of racial criteria The criteria employed are those which are commonly accepted by anthropologists as characterizing the several European subracial stocks (6).

In this study we have followed closely Hooton's method of classification in the segregation of our subjects into phenotype patterns of racial reference. The individuals were sorted out into several groups on the basis of the possession of similar combinations of physical characteristics The primary criteria used were cephalic index, hair color, eye color In addition, for certain types a two-fold division of stature and the nasal index was added to the battery of sorting criteria The resultant types and the details of the sorting criteria on which the classification was made are given in Table 1.

TABLE 1

- I *Mediterranean* (29 individuals)
  - Sorting criteria
    - 1 Cephalic index below 80
    - 2 Eye color pure dark
    - 3 Hair color black, dark brown, red brown (medium)
- II *Keltic* (49 individuals)
  - Sorting criteria
    - 1 Cephalic index below 80
    - 2 Eye color blue
    - 3 Hair color, black, dark brown, red brown, red
- III *Nordic* (6 individuals)
  - Sorting criteria
    - 1 Cephalic index below 80
    - 2 Eye color pure light
    - 3 Hair color ash blond, golden
- IV *Predominantly Nordic* (37 individuals)
  - Sorting criteria
    - 1. Cephalic index below 80
    - 2 Eye color mixed
    - 3 Hair color ash blond, golden brown, light brown, red
    - 4 Stature over 170 cms
    - or
    - 1 Cephalic index below 80
    - 2 Eye color blue
    - 3. Hair color light brown
- V *Alpine* (4 individuals)
  - Sorting criteria
    - 1 Cephalic index over 80
    - 2 Eye color pure dark.
    - 3 Hair color dark brown, black, red-brown
    - 4 Nasal index 63 and over
- VI *East Baltic* (4 individuals)
  - Sorting criteria
    - 1 Cephalic index over 80
    - 2 Eye color pure light
    - 3 Hair color ash blond, golden
    - or
    - 1 Cephalic index over 80

TABLE 1 (*continued*)

2 Eye color mixed
3 Hair color ash blond, golden
or
1 Cephalic index over 80
2 Eye color: light, mixed
3 Hair color red
4 Nasal index 63 or over.

VII *Nordic Mediterranean* (73 individuals)
Sorting criteria
1 Cephalic index below 80
2 Eye color dark
3 Hair color light brown
or
1 Cephalic index below 80
2 Eye color mixed
3 Hair color dark, red brown, red and stature under 170 cms

VIII *Nordic-Alpine* (19 individuals)
Sorting criteria
1 Cephalic index above 80
2 Eye color and hair color all other mixed pigment combinations when nasal index is 63 and over

IX *Dinaric* (39 individuals)
Sorting criteria
1 Cephalic index above 80
2 Eye color and hair color all other mixed pigment combinations when nasal index under 63

Since some of these groupings turned out to be too small for statistical manipulation it was found most desirable to combine some of these types together. The Nordic and Predominantly Nordic classifications were lumped together, as were the Alpine and Nordic-Alpine groups The East Baltic class consisting of only four cases was discarded entirely Accordingly, the final six groupings as used here in this analysis are as given in Table 2

It should be understood these types individually do not constitute groups of persons with exactly the same ethnic derivation They are not groups of

TABLE 2

Phenotype patterns	Hooton nomenclature	Hooton classification	Number of individuals
A	Mediterranean	Primary Subrace	29
B	Keltic	Primary Subrace	19
C	Nordic	Primary Subrace	43
D	Nordic Alpine	Composite Subrace*	23
E	Nordic-Mediterranean	Composite Subrace*	73
F	Dinaric	Composite Subrace*	39
		Total	256

*Residual Mixed Types (Interbreeds see Hooton 6) persons with identical proportions of ancestral strains They are simply individuals with certain mutual physical resemblances The features used for the type sortings are generally regarded as being in the main non-adaptive, hereditary, racial characters And as such, members of each phenotype, it must be supposed, have closer racial relationship to each other than to others belonging to different types

It is not important, for the purposes of this paper, whether or not these phenotype patterns or types are referred to as races, subraces, breeds, kiths, or by some other special classificatory designation. All that is claimed is that these groupings of individuals are phenotype patterns of racial reference, since they are based on criteria which are generally accepted as being of a hereditary and racial character They can, if one so desires, be referred to as simply Types *A*, *B*, *C*, etc. But in the discussion to follow, for the sake of more meaningful description, they will be referred to as Mediterranean, Keltic, Nordic, etc., according to the Hooton nomenclature

C. DESCRIPTION OF PERSONALITY TRAIT GROUPINGS

The nature of the personality trait groupings to be here considered has already been alluded to in the introductory remarks It should be emphasized that these traits are dominant and outstanding features in the individuals, which have emerged from the study of the subjects and not as part of any pre-conceived scheme of personality classification. They simply represent groupings of individuals who showed specific *outstanding* characteristics in common The individual was assigned to the various trait groupings without consideration as to the combination of other traits which may pertain to him

Brief definitions and descriptions of the trait groupings are given below For the convenience of the reader they have been marshalled under suitable category headings descriptive of the trait clusters.

AUTONOMIC FUNCTIONS

Unstable Autonomic Function

A group of young men "who show manifestations of instability in the functions which are generally conceded to be governed by the autonomic nervous system Included are boys who show either periodic excessive anxiety or an undue amount of chronic anxiety as well as those subject to such symptoms as tremulousness, blushing, increased perspiration, palpitation and functional disturbances of the urinary and gastro-intestinal systems"

BASIC PERSONALITY

Well-Integrated Basic Personality

"A group composed of young men who are steady, stable, dependable, thorough, sincere, and trustworthy They have a steadiness and integrity of personality which is not dependent upon autonomic or even emotional stability . "

Less Well-Integrated Basic Personality

"Composed of young men who, in contrast to those of the well-integrated personality, tend towards the erratic, unreliable, sporadic, or undependable Frequently their activities are ill-directed, little organized, and not carried through with the perseverance of those young men who possess a better-integrated basic personality . . "

MOOD DOMINANCE

Mood Fluctuations

"Young men characterized either by strongly marked mood or distinct changes in mood sufficiently striking to be an outstanding feature of their personality There are thus two subgroups those given to mood swings, and those who show a continuous and prominent degree of some quality or phase or mood . "

AFFECT

(This term signifies the outward appearance or impression created by the subject It refers to the basic "expressions of feeling, emotion, and desire" of the individuals)

Vital Affect

"Young men characterized by vitality and richness of affect. They show a spontaneous force and energy which springs from strong affect rather than from an energy which depends upon voluntary effort of the higher ego functions Such boys show a richer verbal expression, greater animation in facial expression, and a more arresting tone of voice. . "

Sensitive Affect

"Includes young men who create the impression of being sensitive, subtle in their thinking, inclined to aestheticism which makes difficult their acceptance of the usual values and adjustment to the realities of life"

Bland Affect

"Young men who show neither warm, positive mood nor richness and vitality of affect They tend to be colorless and neutral in their affective responses In general, they form a group of plain, undistinguished, and uncomplicated individuals. This very absence of positive and stimulating qualities is fundamental "

JUST-SO-BEHAVIOR

Just-So

"Men who are strongly systematic, neat, meticulous, and who depend on orderly routine and regularity. They are rigid and are apt to be upset if their established habits and way of living are interrupted. Some have conceived the trait as so deeply ingrained and beyond voluntary control that it should be grouped under Basic Personality."

VOLUNTARY FUNCTIONS

Inhibited

"Young men who have a strong degree of conscientiousness and who frequently have doubts about doing things which they condone intellectually. They frequently describe a strong sense of responsibility, have difficulty in freeing themselves from their early moral attitudes. A lack of spontaneity and freedom and a degree of stiffness in manner are characteristic . . . ."

Self-Conscious and Introspective

"Individuals who are highly aware of their own thoughts and subjective feelings. They tend to pay more attention to what is going on within themselves than do more natural and outgoing boys. They also have a heightened sense of being observed by other people, even though they know this to be untrue. In consequence, they are self-conscious and cannot behave with directness and ease in social situations."

Self-Driving

Those "who show a high amount of self control, will power, and an ability to force themselves to do things. The energy and accomplishments which result from strength in this aspect of higher ego function are distinguished from the spontaneous activity which springs from strong affect or mood. Many times they are aware of forcing themselves to work against inertia or resistance . . . ."

COGNITIVE FUNCTIONS—MOTIVATIONAL

(This classification encompasses those trait groupings which describe certain dominant motivational aspects of the subjects, such as motivations towards physical science, motivations towards practical organizing, etc.)

Physical Science

Those persons "who have exhibited a predominant interest in physical phenomena. They frequently describe early mechanical interests and aptitudes, preference for scientific subjects in secondary school, and a liking for manipulations of laboratory work . . . ."

Practical Organizing

"Lack of deep interest in any subject matter. They are not theoretical, speculative, or scholarly. Their interests are more practical, and in their course work they are better in organization than in analytical or creative work. They describe an interest in managing or organizing and find their satisfaction in the sense of accomplishment, of 'getting things done' They do not strive after 'higher values' and are essentially pragmatic in their outlook"

Ideational

Young men "who like to deal with ideas and tend to shy away from routine work and problems of practical life They tend to be theoretical or analytical "

Creative and Intuitive

"Characterized by high ability for self-expression or who are original and creative in their thought. Included are those who are strongly intuitive and spurn logical, objective, and analytical forms of thought This group is largely composed of those contemplating artistic or literary careers"

COGNITIVE FUNCTIONS—LIFE ATTITUDES

Pragmatic

Individuals who "are essentially practical in outlook, and are not concerned with an ultimate purpose and value of life. They are apt to be conforming and conventional, and accept the mores of the times They are interested in establishing a family and supporting it comfortably The practical considerations of getting ahead in life outweigh intrinsic interest in work, cultural values, philosophical speculations, or special reform"

Humanistic

Those individuals "who have a dominant interest in people, and for whom a knowledge of people and a desire to do work which will bring them into contact with people is not only an outstanding feature of their personality, but also the strongest driving force in determining their choice of life work

Political

"A group who show a strong interest in social problems, social movements, government, and foreign affairs They are motivated by a desire to participate in work which will lead to improvement of social conditions They are distinguished from the '*humanistic* group inasmuch as they are primarily interested in the broader and more abstract problems of social reform rather than in individual and personal relationships

Cultural

"A group for whom participation in literature or the arts is predominant This interest may be so highly developed that it leads them either to follow an artistic career or to consider any form of life work as a means of existence in order that they may satisfy their cultural needs"

Lack of Purpose and Values

"Young men who lack direction or purpose in life, in whom normal incentives and drives are feebly developed A certain number complain that they have not found any values which make striving in the world worthwhile Many of them are drifting and unenthusiastic, and give the impression of being descendants of a family in whom the original vitality is wearing out A few describe a sincere search for values or higher life purpose which will create the motivating force to make life real and meaningful."

EXPRESSIONISTIC TRAITS

Inarticulate

A group of young men who are characterized by "an inability to express themselves in language Their descriptions are apt to be meagre and matter-of-fact, particularly concerning their own personal feelings and experiences The poverty of verbal content seems not to be due to inhibition or unwillingness, but rather to a certain lack of richness in inner experience and in associated thought"

Verbalistic

The converse of the *Inarticulate,* containing those "who have a facility with language or an ability to verbalize their thoughts in rich or well-formulated language"

SOCIAL FUNCTIONS

Sociable

"A group who are naturally friendly and who like to do things with people Social activities may be their outstanding interest They make friends easily, like to meet new people, and have an ease in their social relationships which is unhampered by shyness or awkwardness"

Shy

Those young men who "experience a high degree of tension in social situations, and are embarrassed, reserved, and awkward in manner There is a fundamental liking for people and a regret that shyness leads them to avoid social events which they would enjoy if they could feel natural A sense of social insecurity and a lack of confidence are frequently described, which are most marked in social situations"

Asocial

A 'group for whom social life, intimate friendships, and an interest in people are relatively unimportant Such young men are satisfied with their own company and in the extreme are considered the 'lone wolves' Their interest in 'things' is of more importance to them than their personal relationships Unlike the shy group, they have no unexpressed liking for people or yearning for social life"

D. PRIMARY SORTING CRITERIA AND PERSONALITY TRAITS

Before proceeding to the study of the relationship between the phenotype patterns of racial reference and the personality trait groupings, it is pertinent to examine the extent of association of the latter with the primary sorting criteria used in the morphological classification of the subjects. To be more specific, to what extent are the primary sorting criteria—hair color, eye color, cephalic index—individually associated with the personality trait groupings?

1. *Hair Color and Personality Traits*

The frequency of the occurrence of the personality trait designations with various shades of hair color is given in Table 3. For the present purpose hair color was separated into three categories, dark, medium, and light.[3] Statistical significance of the association between each personality trait grouping and the gradations of hair color was appraised by the X^2 method based on 3 x 2 tables.

An examination of these data reveals a small number of personality trait-hair color associations which may be considered to be of some significance. Under the expressionistic traits we find that the *inarticulate* grouping is statistically significantly associated with hair color (X^2 8.67, P .01-.02). There is a marked deficiency of the *inarticulate* designation in the individuals with light hair, and a strong excess in the persons with medium hair color. Probable significant associations with hair color are observed in the case of the *physical science motivations* grouping, the *humanistic* and the *shy* groupings. In all three instances the probability of divergence from the independent values falls between .05 and .10. In the case of the *physical science motivations* and *shy* groupings the deficiencies are in the light-haired individuals and the excesses in the subjects with medium hair color. In contrast, a deficiency of dark-haired persons and excesses of medium and light-haired individuals are to be found in the *humanistic* grouping. It would appear, therefore, that individuals with light hair are less prone to fall into the *inarticulate, shy,* and *physical science motivations* groupings; while the persons with medium hair color are more likely to have these trait designations. Lighter hair colors, on the other hand, seem to go more often with the *humanistic* trait. This triad of *inarticulate, shy,* and *physical science motivations,* it should be pointed out, are traits which have been demonstrated

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[3] The dark category includes black hair and dark brown, the medium category contains brown, red brown, and red, the light category golden brown, ash brown, golden and ash.

TABLE 3
HAIR COLOR AND PERSONALITY TRAIT GROUPINGS

	Dark (151) %	Medium (50) %	Light (57) %	Total series (258) %	χ^2	p
Autonomic Functions						
Unstable Autonomic Functions	13.2	12.0	17.5	14.0	1.72	
Basic Personality						
Well-Integrated	57.6	62.0	57.9	59.5	.40	
Less Well-Integrated	13.2	16.0	15.8	14.8	.39	
Mood Dominance						
Mood Fluctuations	14.6	20.0	12.3	16.0	1.42	
Affect						
Vital Affect	17.9	20.0	22.8	20.2	.74	
Sensitive Affect	17.9	16.0	15.8	17.1	.18	
Bland Affect	17.9	24.0	10.5	17.9	4.33	
Just-So Behavior						
Just-So	15.9	16.0	5.3	13.6	4.39	
Voluntary Functions						
Inhibited	16.6	24.0	21.0	19.1	1.49	
Self-Conscious and Introspective	24.5	30.0	21.0	25.3	1.20	
Self-Driving	13.9	6.0	21.0	14.0	3.11	
Cognitive Functions—Motivational						
Physical Science	13.2	18.0	3.5	12.4	5.74	.05-.10
Practical Organizing	39.1	36.0	29.8	37.0	1.54	
Ideational	21.2	24.0	15.8	21.0	1.23	
Creative and Intuitive	6.0	8.0	5.3	6.2	.37	
Cognitive Functions—Life Attitudes						
Pragmatic	41.6	42.0	28.1	38.5	3.28	
Humanistic	11.2	24.0	17.5	15.6	5.03	.05-.10
Political	15.2	22.0	15.8	17.1	1.23	
Cultural	19.9	24.0	19.3	21.0	.49	
Lack of Purpose and Values	21.8	22.0	19.3	21.8	.19	
Expressionistic Traits						
Inarticulate	13.9	26.0	3.5	14.0	8.67	.01-.02
Verbalistic	15.9	20.0	19.3	17.9	.62	
Social Functions						
Sociable	18.5	28.0	21.0	21.4	2.03	
Shy	16.6	28.0	12.3	18.3	4.73	.05-.10
Asocial	9.3	14.0	5.3	9.3	2.48	

to be paired off quite frequently in the subjects studied (2, pp. 54, 59). In a sense they may be said to form a trait syndrome or trait cluster. Their like association with hair color cannot be regarded as a fortuitous circumstance

2 *Eye Color and Personality Traits*

The data relating to the association of the personality trait groupings and eye color gradations are given in Table 4 The various eye colors observed have here been classified into three broad categories, dark, medium, and light [4] An examination of the frequencies as well as the statistical constants used to appraise deviations which may be attributed to random sampling, shows an absence of significant association between the individual personality trait groupings and eye color The largest X^2 for any trait grouping is 3.93 ($P = .14$) which is well below the 5 99 value expected for a probability level of .05 for 2 degrees of freedom

It is interesting to note the personality trait groupings that show regular increased or decreased frequencies as one goes from dark to light eye color. Progressive increases in frequency from dark to light eye color is observed in the case of the *unstable autonomic functions* grouping, the *sociable*, and the *well-integrated* Progressive decreased frequency from dark to light eye color is seen in the *less well-integrated, sensitive affect, just-so, physical science motivations, ideational, cultural, lack of purpose and values, inarticulate, shy,* and *asocial* groupings These latter traits are in the main those which indicate "lesser stability, lesser integration, greater sensitivity and complexity of the personality, and lesser capacity for making easy social adjustments" (7, p 91). It would appear therefore, that the darker the eye color the more frequent are the traits of lesser "soundness" and "stability" of personality. Nevertheless, it may be recalled, none of these traits individually are significantly associated with eye color beyond the error of random sampling

3 *Cephalic Index and Personality Traits*

The percental occurrence of the personality trait groupings for the two cephalic index categories (*CI* below 80 and *CI* 80 and above) are given in Table 5 Traits which appear to be significantly associated with cephalic index are represented only by the *political* and *sensitive affect* groupings Thus, the more roundheaded individuals with cephalic indices over 80 show a marked deficiency of the *political* category ($X^2 = 5\ 16$, $P = 01$-05). They also exhibit a strong deficiency of the *sensitive affect* trait ($X^2 = 3\ 55$, $P =$ about 06). An acceptable level of statistical significance is not reached in the case of all the other traits

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[4] The dark category includes black, dark brown, dark-light brown, light brown, the mixed category gray-brown, green brown, blue brown, and the light class gray, gray-blue, and blue

TABLE 4

EYE COLOR PERSONALITY TRAIT GROUPINGS

	Eye color			Total series	Total series versus				
	Dark (38) %	Mixed (115) %	Light (105) %	(258) %	Dark CR	Mixed CR	Light CR	X^2	P
Autonomic Functions									
Unstable Autonomic Function	5.3	13.9	17.1	14.0	1.43	02	86	3.24	
Basic Personality									
Well-Integrated	52.6	56.5	63.8	58.9	51	33	66	1.95	
Less Well-Integrated	23.7	14.8	11.4	14.7	1.43	02	87	3.29	
Mood Dominance									
Mood Fluctuations	10.5	16.5	15.2	15.1	71	38	02	76	
Affect									
Vital Affect	18.4	18.3	21.9	19.8	18	38	48	51	
Sensitive Affect	18.4	17.4	14.8	17.0	20	09	19	11	
Bland Affect	18.4	14.8	20.0	17.4	16	67	63	1.06	
Just-So Behavior									
Just-So	21.0	13.0	11.4	13.6	1.23	15	61	2.20	
Voluntary Functions									
Inhibited	10.5	23.5	17.1	18.9	1.19	1.14	49	3.56	
Self-Conscious and Introspective	23.7	27.0	22.8	24.8	13	47	39	51	
Self-Driving	13.2	17.4	10.5	14.0	13	97	97	2.20	
Cognitive Functions—Motivational									
Physical Science	15.8	13.0	9.5	12.0	65	32	73	1.19	
Practical Organizing	42.1	33.0	39.0	36.8	53	66	39	1.37	
Ideational	23.7	22.6	18.1	20.9	39	41	62	88	
Creative and Intuitive	0	7.8	6.7	6.2	1.55	71	20	3.13	
Cognitive Functions—Life Attitudes									
Pragmatic	44.7	35.6	39.0	38.4	63	48	11	1.04	
Humanistic	15.8	13.0	18.1	15.5	04	66	67	1.05	
Political	13.2	20.9	14.3	17.0	59	99	66	2.13	
Cultural	18.4	22.6	20.0	20.9	32	41	19	39	
Lack of Purpose and Values	26.3	25.2	15.2	21.3	67	91	1.35	3.93	
Expressionistic Traits									
Inarticulate	23.7	14.8	9.5	14.0	1.61	22	1.25	3.11	
Verbalistic	15.8	19.1	17.1	17.8	31	33	16	29	
Social Functions									
Sociable	18.4	19.1	24.8	21.3	38	.50	76	1.24	
Shy	21.0	20.0	14.3	17.8	.46	55	86	1.52	
Asocial	13.2	10.4	6.7	9.3	80	40	89	1.76	

TABLE 5

CEPHALIC INDEX AND PERSONALITY TRAIT GROUPINGS

	Cephalic Index		Total	Total series versus			
	Below 80 (194) %	Above 80 (64) %	series (258) %	Below 80 *CR*	Above 80 *CR*	X^2	*P*
Autonomic Functions							
Unstable Autonomic Function	14.9	10.9	14.0	34	67	66	
Basic Personality							
Well-Integrated	57.2	64.1	58.9	31	54	94	
Less Well-Integrated	16.5	9.4	14.7	66	1.11	1.95	
Mood Dominance							
Mood Fluctuations	15.5	14.1	15.1	13	22	.08	
Affect							
Vital Affect	19.1	21.9	19.8	22	36	22	
Sensitive Affect	19.6	9.4	17.0	87	1.48	3.55	05-10
Bland Affect	18.0	15.6	17.4	21	33	18	
Just-So Behavior							
Just-So	11.8	18.8	13.6	.66	1.16	2.05	
Voluntary Functions							
Inhibited	19.6	17.2	18.9	21	32	17	
Self-Conscious and Introspective	25.2	23.4	24.8	13	23	10	
Self-Driving	13.4	15.6	14.0	23	33	19	
Cognitive Functions—Motivational							
Physical Science	11.8	12.5	12.0	06	11	01	
Practical Organizing	37.6	34.4	36.8	19	33	23	
Ideational	22.7	15.6	20.9	55	93	1.47	
Creative and Intuitive	7.2	3.1	6.2	58	1.00	1.47	
Cognitive Functions—Life Attitudes							
Pragmatic	36.6	43.8	38.4	41	68	1.02	
Humanistic	15.5	15.6	15.5	02	03	0	
Political	20.1	7.8	17.0	1.04	1.79	5.16	01-05
Cultural	21.1	20.3	20.9	08	11	02	
Lack of Purpose and Values	22.2	18.8	21.3	.26	43	32	
Expressionistic Traits							
Inarticulate	15.5	9.4	14.0	54	1.00	1.50	
Verbalistic	20.1	10.9	17.8	.77	1.30	2.78	05-10
Social Functions							
Sociable	20.6	23.4	21.3	20	38	23	
Shy	20.1	10.9	17.8	77	1.30	2.78	05-10
Asocial	10.8	4.7	9.3	71	1.22	2.19	

In spite of the general absence of numerous statistically valid associations between the personality trait groupings and cephalic index, the tabular data present an interesting manifestation If we list those traits which are more frequently represented in the above 80 category than in the below 80 group, they form a distinct and identifiable syndrome The list includes the following groupings: *well-integrated, vital affect, just-so, self-driving, physical science motivations, pragmatic, humanistic, and sociable*. These traits (omitting self-driving and just-so) are those which are "suggestive of stability, good integration, and ease of making social adjustments" The differences involved, it is true, are very small, but the consistency of the pattern of traits is highly intriguing

Briefly summarized, only a few individual trait groupings appear to be significantly associated with the primary sorting criteria—hair color, eye color, and cephalic index Beyond the question of statistical significance, there does seem to be a trend for those individuals with darker shades of hair color and eye color to exhibit more frequently those traits indicating lesser integration, lesser stability, and greater sensitivity and complexity The rounder-headed individuals, on the whole, appear to show a greater frequency of the more stable, steady pragmatic traits.

E PHENOTYPE PATTERNS AND PERSONALITY TRAITS

The phenotype patterns of racial reference which have been described earlier in this paper are here examined for their possible association with the dominant personality trait groupings. For testing statistical significance, the X^2 method has been used treating each of the trait groupings in the form of a 2 x 2 table with one degree of freedom.

1. *"Mediterranean"*

The frequency of the occurrence of the various dominant personality traits in the "Mediterranean" racial grouping is given in Table 6 It appears that the "Mediterranean" individuals show significant differentiation in the case of at least two personality trait categories, the *less-well integrated* and the *inarticulate* In both instances these traits are about twice as frequent in the "Mediterraneans" as in the series as a whole. The data for the *less well-integrated* give a value of X^2 of 6.86 and P of less than 0.01, and for the inarticulate grouping a X^2 of 4 93 with a value of P between 0 01 and 0 05 Other trait groupings which may be considered as approaching the level of statistical significance from their independence values are the *unstable autonomic functions, just-so,* and the *lack of purpose and values*

TABLE 6

"MEDITERRANEAN" AND PERSONALITY TRAIT GROUPINGS

	"Mediterranean" (29) No	%	Total series (258) No	%	X^2	P
Autonomic Functions						
Unstable Autonomic Functions	1	3.4	36	14.0	3.02	.05-.10
Basic Personality						
Well-Integrated	16	55.2	153	59.5	.23	
Less Well-Integrated	9	31.0	38	14.8	6.86	> .01
Mood Dominance						
Mood Fluctuations	3	10.3	41	16.0	.71	
Affect						
Vital Affect	4	13.8	52	20.2	.85	
Sensitive Affect	6	20.7	44	17.1	.29	
Bland Affect	6	20.7	46	17.9	.18	
Just-So Behavior						
Just-so	7	24.1	35	13.6	3.20	.05-.10
Voluntary Functions						
Inhibited	4	13.8	49	19.1	.56	
Self-Conscious and Introspective	7	24.1	65	25.3	.02	
Self-Driving	3	10.3	36	14.0	.37	
Cognitive Functions—Motivational						
Physical Science	4	13.8	32	12.4	.06	
Practical Organizing	14	48.3	95	37.0	1.87	
Ideational	8	27.6	54	21.0	.87	
Creative and Intuitive	0	0	16	6.2	2.16	
Cognitive Functions—Life Attitudes						
Pragmatic	13	44.8	99	38.5	.56	
Humanistic	4	13.8	40	15.6	.07	
Political	6	20.7	44	17.1	.29	
Cultural	7	24.1	54	21.0	.21	
Lack of Purpose and Values	10	34.5	55	21.8	3.39	.05-.10
Expressionistic Traits						
Inarticulate	8	27.6	36	14.0	4.93	.01-.05
Verbalistic	6	20.7	46	17.9	.19	
Social Functions						
Sociable	3	10.3	55	21.4	2.32	
Shy	8	27.6	47	18.3	1.91	
Asocial	4	13.8	24	9.3	.77	

groupings. These three trait series have values of P between 0.05 and 0.10. The "Mediterraneans" are deficient in *unstable autonomic functions* designations and show excesses of the *just-so* and *lack of purpose and values* categories.

2. *"Keltic"*

The "Keltic" racial grouping shows a highly significant differentiation in only one trait category, the *self-driving*. In the series as a whole 14 per cent of individuals were classified as *self-driving*, while among the "Keltics" only

TABLE 7
"KELTIC" AND PERSONALITY TRAIT GROUPINGS

	"Keltic" (49) No.	"Keltic" (49) %	Total series (258) No.	Total series (258) %	X^2	P
Autonomic Functions						
Unstable Autonomic Functions	8	16.3	36	14.0	.28	
Basic Personality						
Well-Integrated	31	63.3	153	59.5	.39	
Less Well-Integrated	5	10.2	38	14.8	1.02	
Mood Dominance						
Mood Fluctuations	7	14.3	41	16.0	.10	
Affect						
Vital Affect	10	20.4	52	20.2	0	
Sensitive Affect	7	14.3	44	17.1	.34	
Bland	13	26.5	46	17.9	3.07	.05-.10
Just-So Behavior						
Just-So	7	14.3	35	13.6	.01	
Voluntary Functions						
Inhibited	8	16.3	49	19.1	.29	
Self-Conscious and Introspective	14	28.6	65	25.3	.36	
Self-Driving	1	2.0	36	14.0	7.12	>.01
Cognitive Functions—Motivational						
Physical Science	8	16.3	32	12.4	.83	
Practical Organizing	23	46.9	95	37.0	2.66	
Ideational	9	18.4	54	21.0	.24	
Creative and Intuitive	4	8.2	16	6.2	.44	
Cognitive Functions—Life Attitudes						
Pragmatic	22	44.9	99	38.5	1.06	
Humanistic	11	22.4	40	15.6	2.26	
Political	5	10.2	44	17.1	2.01	
Cultural	8	16.3	54	21.0	.79	
Lack of Purpose and Values	6	12.2	55	21.8	2.97	.05-.10
Expressionistic Traits						
Inarticulate	7	14.3	36	14.0	0	
Verbalistic	9	18.4	46	17.9	0	
Social Functions						
Sociable	15	30.6	55	21.4	3.09	.05-.10
Shy	8	16.3	47	18.3	.16	
Asocial	4	8.2	24	9.3	.10	

2 per cent were so designated (P = less than 0.01). Traits with values of P between 0.05 and 0.10 appear in the case of the *bland, sociable,* and *lack of purpose and values* groupings. The "Keltics" have excesses of the *bland* and *sociable* traits, and a deficiency of the *lack of purpose and value* category.

3. *"Nordic"*

Table 8 gives the data for the personality trait frequencies in the "Nordic" racial grouping. None of the trait groupings exhibit a comfortable level of statistical significance, nor in the aggregate do they suggest any evidence of special trait differentiation for this racial category.

TABLE 8

"NORDIC" AND PERSONALITY TRAIT GROUPINGS

	"Nordic" (37)		Total series (258)			
	No.	%	No.	%	X^2	P
Autonomic Functions						
Unstable Autonomic Functions	9	24.3	36	14.0	3.81	.05-.10
Basic Personality						
Well-Integrated	22	59.5	153	59.5	0	
Less Well-Integrated	6	16.2	38	14.8	.84	
Mood Dominance						
Mood Fluctuations	5	13.5	41	16.0	.17	
Affect						
Vital Affect	9	24.3	52	20.2	.45	
Sensitive Affect	7	18.9	44	17.1	.12	
Bland	3	8.1	46	17.9	2.75	.05-.10
Just-So Behavior						
Just-So	2	5.4	35	13.6	2.40	
Voluntary Functions						
Inhibited	10	27.0	49	19.1	1.77	
Self-Conscious and Introspective	8	21.6	65	25.3	.31	
Self-Driving	8	21.6	36	14.0	2.07	
Cognitive Functions—Motivational						
Physical Science	1	2.7	32	12.4	3.77	.05-.10
Practical Organizing	13	35.1	95	37.0	.05	
Ideational	9	24.3	54	21.0	.28	
Creative and Intuitive	2	5.4	16	6.2	.05	
Cognitive Functions—Life Attitudes						
Pragmatic	11	29.7	99	38.5	1.33	
Humanistic	7	18.9	40	15.6	.37	
Political	8	21.6	44	17.1	.66	
Cultural	7	18.9	54	21.0	.11	
Lack of Purpose and Values	9	24.3	55	21.8	.26	
Expressionistic Traits						
Inarticulate	2	5.4	36	14.0	2.64	
Verbalistic	7	18.9	46	17.9	.04	
Social Functions						
Sociable	8	21.6	55	21.4	0	
Shy	6	16.2	47	18.3	.13	
Asocial	3	8.1	24	9.3	.06	

4. "Nordic-Alpine"

No significant differentiation in the personality traits considered individually is found for the "Nordic-Alpine" group.

5. "Nordic-Mediterranean"

In the case of the "Nordic-Mediterraneans" statistically significant differentiation is exhibited by the *sensitive affect, creative and intuitive*, and *political* trait groupings (Table 10). All of the traits are in excess in the "Nordic

TABLE 9

"NORDIC-ALPINE" AND PERSONALITY TRAIT GROUPINGS

	"Nordic-Alpine" (22)		Total series (258)			
	No.	%	No	%	X^2	P
Autonomic Functions						
Unstable Autonomic Functions	3	13.6	36	14.0	0	
Basic Personality						
Well-Integrated	13	59.1	153	59.5	.08	
Less Well-Integrated	1	4.6	38	14.8	2.02	
Mood Dominance						
Mood Fluctuations	4	18.2	41	16.0	.10	
Affect						
Vital Affect	3	13.6	52	20.2	.60	
Sensitive Affect	2	9.1	44	17.1	1.10	
Bland Affect	5	22.7	46	17.9	.42	
Just-So Behavior						
Just-So	3	13.6	35	13.6	0	
Voluntary Functions						
Inhibited	5	22.7	49	19.1	.23	
Self-Conscious and Introspective	7	31.8	65	25.3	.54	
Self-Driving	3	13.6	36	14.0	0	
Cognitive Functions—Motivational						
Physical Science	4	18.2	32	12.4	1.81	
Practical Organizing	4	18.2	95	37.0	3.53	.05-.10
Ideational	4	18.2	54	21.0	.06	
Creative and Intuitive	0	0	16	6.2	1.67	
Cognitive Functions—Life Attitudes						
Pragmatic	7	31.8	99	38.5	.45	
Humanistic	3	13.6	40	15.6	.05	
Political	3	13.6	44	17.1	.22	
Cultural	4	18.2	54	21.0	.10	
Lack of Purpose and Values	7	31.8	55	21.8	1.56	
Expressionistic Traits						
Inarticulate	3	13.6	36	14.0	0	
Verbalistic	3	13.6	46	17.9	.26	
Social Functions						
Sociable	5	22.7	55	21.4	.03	
Shy	2	9.1	47	18.3	1.31	
Asocial	1	4.6	24	9.3	.62	

TABLE 10

"NORDIC MEDITERRANEAN" AND PERSONALITY TRAIT GROUPINGS

	"Nordic Mediterranean" (73)		Total series (258)			
	No	%	No	%	X^2	P
Autonomic Functions						
Unstable Autonomic Functions	11	15.1	36	14.0	10	
Basic Personality						
Well-Integrated	41	56.2	153	59.5	40	
Less Well-Integrated	11	15.1	38	14.8	0	
Mood Dominance						
Mood Fluctuations	14	19.2	41	16.0	80	
Affect						
Vital Affect	13	17.8	52	20.2	33	
Sensitive Affect	18	24.7	44	17.1	4.10	01-.05
Bland Affect	13	17.8	46	17.9	0	
Just-So Behavior						
Just-So	6	8.2	35	13.6	2.45	
Voluntary Functions						
Inhibited	16	21.9	49	19.1	57	
Self-Conscious and Introspective	20	27.4	65	25.3	25	
Self-Driving	14	19.2	36	14.0	2.34	
Cognitive Functions—Motivational						
Physical Science	10	13.7	32	12.4	14	
Practical Organizing	23	31.5	95	37.0	1.24	
Ideational	18	24.7	54	21.0	86	
Creative and Intuitive	8	11.0	16	6.2	4.03	01-.05
Cognitive Functions—Life Attitudes						
Pragmatic	25	34.2	99	38.5	73	
Humanistic	7	9.6	40	15.6	2.69	
Political	19	26.0	44	17.1	5.75	01-.02
Cultural	18	24.7	54	21.0	86	
Lack of Purpose and Values	19	26.0	55	21.8	1.37	
Expressionistic Traits						
Inarticulate	13	17.8	36	14.0	1.26	
Verbalistic	16	21.9	46	17.9	1.13	
Social Functions						
Sociable	12	16.4	55	21.4	1.42	
Shy	17	23.3	47	18.3	1.73	
Asocial	10	13.7	24	9.3	2.18	

Mediterraneans" over the total series frequencies. The values of P for the *sensitive affect, political* grouping, and *creative and intuitive* categories lie between 0.01 and 0.05. It is to be further noted that the following traits are less frequent in the "Nordic-Mediterraneans" than in the total series: *well-integrated, vital affect, just-so, practical organizing, humanistic,* and *sociable.* Although the deviations of these groups are not sufficiently large as to be considered statistically significant, nevertheless, with the exception of the *just-so* group they are all traits which make for better integration and social adjustment. In other words, there is a trend among the "Nordic-Mediterraneans" for a somewhat smaller representation of those dominant traits which make for better stability of personality.

6. *"Dinaric"*

The group of individuals classified as "Dinaric" show a statistically significant excess of persons designated as *pragmatic*. Other traits which approach

TABLE 11

"DINARIC" AND PERSONALITY TRAIT GROUPINGS

	"Dinaric" (39)		Total series (258)			
	No.	%	No.	%	χ^2	*P*
Autonomic Functions						
Unstable Autonomic Functions	4	10.3	36	14.0	.54	
Basic Personality						
Well-Integrated	28	71.8	153	59.5	2.96	.05-.10
Less Well-Integrated	3	7.7	38	14.8	1.84	
Mood Dominance						
Mood Fluctuations	4	10.3	41	16.0	1.05	
Affect						
Vital Affect	12	30.8	52	20.2	3.18	.05-.10
Sensitive Affect	3	7.7	44	17.1	2.88	.05-.10
Bland Affect	4	10.3	46	17.9	1.80	
Just-So Behavior						
Just-So	9	23.1	35	13.6	3.57	.05-.10
Voluntary Functions						
Inhibited	6	15.4	49	19.1	.36	
Self-Conscious and Introspective	7	18.0	65	25.3	1.30	
Self-Driving	7	18.0	36	14.0	.59	
Cognitive Functions—Motivational						
Physical Science	4	10.3	32	12.4	.18	
Practical Organizing	18	46.2	95	37.0	1.73	
Ideational	5	12.8	54	21.0	1.83	
Creative and Intuitive	1	2.6	16	6.2	1.01	
Cognitive Functions—Life Attitudes						
Pragmatic	21	53.8	99	38.5	4.66	.01-.05
Humanistic	8	20.5	40	15.6	.87	
Political	3	7.7	44	17.1	2.88	.05-.10
Cultural	9	23.1	54	21.0	.13	
Lack of Purpose and Values	4	10.3	55	21.8	1.33	
Expressionistic Traits						
Inarticulate	3	7.7	36	14.0	1.53	
Verbalistic	3	7.7	46	17.9	3.23	.05-.10
Social Functions						
Sociable	10	25.6	55	21.4	.55	
Shy	5	12.8	47	18.3	.87	
Asocial	2	5.1	24	9.3	.92	

statistical significance (P between 0 05 and 0 10) are the *well-integrated, vital affect, sensitive affect, political,* and *verbalistic* categories The latter three trait groupings are less frequently represented in the "Dinarics" than in the series as a whole.

It would appear that as regards these data, there is no evidence of extensive association between the individual racial groupings and the personality traits. There is, it is true, an occasional trait here and there which is significantly differentiated within a phenotype category, but these do not form any clear or consistent pattern on which we may place much reliance However, it must be remembered that the small size of most of the racial groupings makes it exceedingly difficult to obtain deviations at a comfortable level of statistical significance unless such deviations from independence frequencies are of considerable magnitude The possibility remains that there may be some relationships of a very slight nature between the racial groupings and the personality traits, but these cannot be clearly established from these data.

F INDIVIDUAL PERSONALITY TRAITS AND "RACIAL" GROUPINGS

In the preceding section, the individual "racial" groupings were analyzed for association with the list of dominant personality traits. To explore further the existence of any possible association, the data have been treated here from an alternative point of view, namely that of the personality traits. The question can then be answered as to whether or not the personality traits considered individually show any association with the "racial" groupings as a whole

Table 12 presents the percental frequency of the individual personality traits in each of the "racial" groupings Again the X^2 method has been used for estimation of significant deviation from independence values, with P computed on the basis of 6 x 2 tables with five degrees of freedom.

It may be seen from these figures that there is only one dominant personality trait category, the *less well-integrated,* that is statistically significantly differentiated with regard to the racial groupings. In the case of the *less well-integrated,* the value of P lies between 0 01 and 0 05 There are also four other personality categories which approach the level of statistical significance with values of P between 0 05 and 0.10 There are the *just-so* group, the *self-driving,* the *practical organizing,* and the *lack of purpose and values* categories. In all the other personality traits, the values of P are well below the level of statistical significance.

TABLE 12
"RACIAL" GROUPINGS AND PERSONALITY TRAITS

	Total Series (258) No	Total Series (258) %	Medit (29) %	Keltic (49) %	Nordic (37) %	Nordic Alpine (22) %	Nordic Medit (75) %	Dinaric (39) %	X^2	P
Autonomic Functions										
Unstable Autonomic Functions	36	14.0	3.4	16.3	24.3	13.6	15.1	10.3	6.72	
Basic Personality										
Well-Integrated	153	59.5	55.2	63.3	59.5	59.1	56.2	71.8	3.34	
Less Well-Integrated	38	14.8	31.0	10.2	16.2	4.6	15.1	7.7	11.17	.01-.05
Mood Dominance										
Mood Fluctuations	41	16.0	10.3	14.3	13.5	18.2	19.2	10.3	2.42	
Affect										
Vital Affect	52	20.2	13.8	20.4	24.3	13.6	17.8	30.8	4.63	
Sensitive Affect	44	17.1	20.7	14.3	18.9	9.1	24.7	7.7	7.01	
Bland Affect	46	17.9	20.7	26.5	8.1	22.7	17.8	10.3	6.92	
Just-So Behavior										
Just-So	35	13.6	24.1	14.3	5.4	13.6	8.2	23.1	9.71	.05-.10
Voluntary Functions										
Inhibited	49	19.1	13.8	16.3	27.0	22.7	21.9	15.4	3.13	
Self-Conscious	65	25.3	24.1	28.6	21.6	31.8	27.4	18.0	2.33	
Self-Driving	36	14.0	10.3	2.0	21.6	13.6	19.2	18.0	10.07	.05-.10
Cognitive Functions—Motivational										
Physical Science	32	12.4	13.8	16.3	2.7	18.2	13.7	10.3	4.91	
Practical Organizing	95	37.0	48.3	46.9	35.1	18.2	31.5	46.2	9.39	.05-.10
Ideational	54	21.0	27.6	18.4	24.3	18.2	24.7	12.8	3.44	
Creative and Intuitive	16	6.2	0	8.2	5.4	0	11.0	2.6	7.60	
Cognitive Functions—Life Attitudes										
Pragmatic	99	38.5	44.8	44.9	29.7	31.8	34.2	53.8	7.32	
Humanistic	40	15.6	13.8	22.4	18.9	13.6	9.6	20.5	4.90	
Political	44	17.1	20.7	10.2	21.6	13.6	26.0	7.7	9.22	
Cultural	54	21.0	24.1	16.3	18.9	18.2	24.7	23.1	1.74	
Lack of Purpose and Values	55	21.8	34.5	12.2	24.3	31.8	26.0	10.3	10.65	.05-.10
Expressionistic Traits										
Inarticulate	36	14.0	27.6	14.3	5.4	13.6	17.8	7.7	8.82	
Verbalistic	46	17.9	20.7	18.4	18.9	13.6	21.9	7.7	5.99	
Social Functions										
Sociable	55	21.4	10.3	30.6	21.6	22.7	16.4	25.6	6.08	
Shy	47	18.3	27.6	16.3	16.2	9.1	23.3	12.8	5.09	
Asocial	24	9.3	13.8	8.2	8.1	4.6	13.7	5.1	3.67	

G. COMMENT

The results of the analysis show the absence of any extensive association between the racial groupings and the dominant personality traits. However, there is no evidence of complete disassociation A few of the individual trait groupings appear to be significantly associated with the primary sorting criteria, and among the phenotypes an occasional trait here and there exhibits a significant difference.

In assessing these results, it is necessary to keep several points in mind To begin with, the size of the series although moderate when considered in its entirety becomes relatively small when broken down into subsamples in the racial and personality classifications. Accordingly the possibility remains that with a substantially larger series many more significant differentiations might be demonstrated, and logical, consistent patterns might emerge Attention must also be drawn to the nature of the sample under study. The series of individuals is a highly selected one in several respects We are dealing with subjects who are students in a large Eastern privately endowed University, selected from the main body for its "normality," good overt social adjustment, good health, and satisfactory academic performance At best it is representative of only a very small segment of our total population. The restrictive character of the sample may thus militate against the appearance of substantial associations between personality and race, if these in fact do exist. Consideration must also be given to the limitations of the personality traits themselves. It is thus apparent, that the test of possible association between personality and race with the material here presented is indeed a very stringent one.

On the other hand, no corrections have been applied to those significant differences which have emerged, with regard to social, economic, religious, and other distinctions between the racial groupings. Such corrections might have served to reduce the differences to a level below that of statistical significance. However, it was not deemed expedient to apply these corrections because of the paucity of significant deviations, the small magnitude of the differences themselves, and the limitations of the data.

The rôle of race in personality, among White Americans at this selecting level, is probably at best only a *very minor* one. In group distinctions its influence may be hardly perceptible and unimportant For the individual, certainly, his racial characteristics for all practical purposes may be entirely ignored as an hereditary determiner of personality The conclusion seems warranted that in the realm of morphology and personality differentiations, body build types appear to transcend many other distinctions, with race occupying a residual and for the most part an inappreciable position.

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VOCABULARY AND MENTAL MEASUREMENT: A QUANTITATIVE INVESTIGATION AND REVIEW OF RESEARCH*

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A. INTRODUCTION

Of all human characteristics by which one person is judged by others, vocabulary occupies a position among the foremost. During routine daily contacts, both in social and occupational spheres, our vocabularies are in constant use in the communications of ideas, the expression of feeling and emotion, in making our wants known, and in plying our respective professions and trades. To a skilled observer, a man's vocabulary can yield much information about himself—his approximate educational status, his social position, his vocational pursuits, the geographical area from which he comes, and his cultural level, to name but a few of many. Individuals are characterized by the quantity and quality of words they use, just as they are by their physical attributes, manner of dress, and habit patterns in general. In such characterization, vocabulary is perhaps a more valid and stable index, since it is started at an early age, develops with time, and thus becomes a more or less automatic function which is not readily changed at will. Without doubt, few people give as much attention to their vocabularies as they do to the many other aspects of their personalities. The rôle played by the use of words in setting man apart from other animal species, and in the development of civilization in general, is too obvious to warrant special mention.

The importance of vocabulary in determining the impression a person will make during a vocational, social, or clinical interview merits attention, since many interviewers, especially when pressed for time, have little more to go on in the evaluation of their clients' abilities and potentialities. Schwesinger (56), in her paper on the significance of vocabulary in the interview, has discussed this point and contends that the factors determining the quality and extent of a person's vocabulary include general intelligence

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[1] The data presented in this paper were collected by the author while on active duty in the U. S. Navy, World War II.

chronological age up to adult mental levels, and environment, which in turn embraces education, general knowledge, social and cultural background, special interests, and special experiences. While this is probably true in the majority of cases, it is likewise true that a seemingly sound vocabulary may be used as a compensatory measure in instances where such factors as education, general intelligence, and environmental opportunities are lacking. In this regard, it is conceivable for a person to establish through conscious effort an apparently strong vocabulary and thus create a favorable initial impression while at the same time be lacking in more fundamental attributes. This is an ever-present possibility for which to be alert in the evaluation of an individual on the basis of the words he uses alone.

2. *The Measurement of Vocabulary*

It is, of course, impossible to obtain a precise quantification of an individual's vocabulary unless the time-consuming procedure of subjecting that individual to the definition of every known word is employed. To meet this situation, dependence is placed in sampling techniques, based on the theory that characterizes statistical procedures generally. Briefly, this involves the selection of a given number of words at random from a standard dictionary on the assumption that the individual's knowledge of these words will provide an index of his knowledge of the total number of words from which the sample was selected Thus, the vocabulary test of the 1916 *Stanford Revision of the Binet Tests* (63) is composed of 100 words derived by selecting the last word of every sixth column in a dictionary containing approximately 18,000 words, presumably the 18,000 most common words in the language. The 42-word vocabulary subtest of the *Wechsler-Bellevue Adult Intelligence Scale* (67) was constructed in a similar manner Both represent but single subtests of more extensive batteries and in that regard will be discussed in more detail later.

Tests of vocabulary may, for convenience, be classified first, in terms of the type of vocabulary they are designed to measure, and second, according to their method of administration. Under the first classification are found *general* tests, which yield approximations of an individual's knowledge of words generally, and *specific* tests, which provide estimates of a person's vocabulary as it applies to particular fields. Listed under the second classification are *oral* tests, which are administered verbally and usually individually, and written tests, which are of the paper-and-pencil variety and may be given individually or to a group. Good examples of general tests which are of the oral type are those found in the Stanford-Binet and Bellevue batteries cited above. General tests of the written variety are exemplified in the *Columbia Vocabulary Test* and in the *Wide Range Vocabulary Test* of Atwell and Wells. The *Knauber Art Vocabulary Test,* which has as its purpose the evaluation of an individual's knowledge of artistic terms, illustrates adequately a specific test which is also of the written variety. The *Michigan Vocabulary Profile Test,* which is designed to provide a profile of a subject's vocabulary in several fields of information (human relations, commerce, government, physical sciences, biological sciences, mathematics, fine arts, sports), is an example of eight specific written tests collected together and administered as a single examination.

Judging by their widespread use, present measures of vocabulary appear to have met with general acceptance on the part of those employing such clinical tools The choice of the type of test used is in most cases doubtless dependent upon the needs and particular bent of the examiner. Although *few data are available regarding the validity of the various types of tests, one* investigation in particular may be cited. Kelley (33), in an experimental study of various techniques for testing word meanings, considered the multiple-choice, "same-opposite-neither," matching, and multiple-choice-sentence varieties, and found that the same-opposite-neither test and the multiple-choice-sentence test were slightly lower in validity than the others. The matching and multiple-choice tests were found to be the best techniques and were of approximately equal validity as methods of measuring the word meaning knowledge of children.

An outspoken critic of certain measures of vocabulary in use today, specifically the type found in the *Terman-Merrill Revision of the Binet* (65), is Kent (34), who contends that a sample of words selected by rule from a dictionary is not adequate to justify the estimation of an individual's entire vocabulary, and that the plan of having the words orally defined by the subject is open to serious objection Instead, she advocates the use of the multiple-choice type *if vocabulary tests are to be used in examinations of* general intelligence at all.

Feinberg (18) cautions that the method of selecting words at random for a vocabulary list with the purpose of determining intellectual levels will not be so valuable as a method which would include the study of each word in relation to its history and popular conception in the several geographical divisions and sociological groupings of the country.

3 *Vocabulary Tests in Psychometric Procedures*

Today, as they have in the past, tests of vocabulary occupy prominent places in various batteries of tests designed to measure general intelligence An early example is found in the 1916 *Stanford Revision of the Binet Tests* (63), which contained a vocabulary test of 100 words divided into two lists of 50 words each. In most instances, it was recommended that the entire 100 words be administered, however, in cases where it was necessary to conserve time, it was permissible to employ but one list and multiply the score by two Louden (39) compared the performance of subjects on these two lists and found that List I was decidedly easier than List II at the lower intellectual levels, approximately equal to List II at the 14-year level, and more difficult than List II at the two adult levels. In view of this discrepancy, she recommended the use of the combined lists on which the Stanford standardization was based Peatman and Peatman (49) used 642 subjects in comparing the two lists and report that in about one case in five, a subject's total vocabulary score would have been in error if estimated from the results of only one of the lists Although there was little difference between the two lists in so far as validity was concerned, the left list (List I) was found to be the more reliable, i.e., the scores from this list deviated less from the expected score, on the whole, than did those obtained on the right list (List II) The authors conclude that it is always preferable, whenever possible, to administer the *complete* Binet test, rather than placing entire dependence on the vocabulary test alone

Feinberg (18, 19), in two papers, has noted the improper placement of certain words in these vocabulary word-lists in so far as difficulty is concerned, and contends that this is probably due to insufficient standardization

In the *Terman-Merrill Revision of the Binet* (65), which appeared in 1937, the vocabulary test found in Form *L* of that examination comprises 45 words selected from the two lists of 50 words each of the 1916 Revision. Thirty-four of these words were taken from List I and 11 from List II of the earlier revision Subsequent research pointed to the fact that the two tests did not yield exactly comparable results. Atwell (4) administered the 100 words constituting the vocabulary test of the 1916 Revision to 100 subjects and from these partialed out the 45 words comprising the vocabulary test of the 1937 Revision The correlation between the two tests was .86 The mental age rating from the vocabulary test of the 1937 Revision was invariably higher than that obtained from the 1916 Revision. The average mental age derived from the 1916 test was 14 0 and the average mental age from the 1937 test was 17 4, while the average of the differences in mental age ratings was 3 81 years

The vocabulary subtest of the *Wechsler-Bellevue Adult Intelligence Scale* (67), while relegated to the status of an alternate test in the entire scale, is nevertheless considered by Wechsler to be a valid index of general intelligence in itself. He admits, however, that the 42 words comprising the test probably are not placed in the exact order of difficulty Rapaport (52) has also noted this, and as the result of his experiences with the test has classified the words into four degrees in so far as difficulty is concerned. Since much of the data to be presented in this paper have reference to this test, further discussion of it will be held in abeyance and consideration will be given it in subsequent subsections

While admitting a frank dislike of tests calling for the definition of words, Kent (35), in her "emergency" battery of one-minute tests, includes a "definitions" subtest, which includes three lists of words, grouped as nouns, adjectives, and verbs Mention is made of this test because of its widespread use during World War II as a screening instrument in the selection of military personnel.

4 *Vocabulary and General Intelligence*

With few exceptions, there is general agreement that tests of vocabulary provide reliable indices of general intelligence, even when employed independently for this purpose An enthusiastic advocate of the use of vocabulary tests is Armstrong, who speaks of the Stanford-Binet vocabulary test as "a divining rod of intellect particularly sensitive to intelligence and individual differences . " (3, p 272) Regarding his 1916 Revision of the Binet tests, Terman (63) contends that the vocabulary test has a higher value by far than any other single test of the scale A similar contention is made with reference to the 1937 Revision (65, p. 302).

> We have found the vocabulary test to be the most valuable single test in the scale. Its interest value is high, it presents a familiar task to the subject, and the fact that it begins with words in common use and increases rapidly in difficulty gives the examiner a rapid survey method of estimating the subject's ability.

Wechsler (67) also considers the size of a man's vocabulary to be an excellent measure of his general intelligence and believes that apart from its value as a measure of intelligence, the vocabulary test is desirable because of its qualitative possibilities

Subsequent research has tended to substantiate these opinions Weisenburg, Roe, and McBride (69) found vocabulary tests well suited for work with adults and reports substantial positive correlations between vocabulary and intelligence test ratings Elwood (17) likewise indicates a high correlation between mental age and vocabulary score on the 1937 Revision of the Binet. Spache (62) found that mental ages derived from this test may be predicted with a fair degree of accuracy by the mental ages obtained from the vocabulary section

Because they are relatively inoffensive to the majority of persons, and because of the comparative ease with which they can be administered, tests of vocabulary have been employed in selection procedures in military settings As early as 1941, Atwell, Bloomberg, and Wells (5) report the use of a vocabulary test as one of a battery employed in mental testing at an Army induction center Bobbitt and Newman (10) mention the use of a vocabulary test for examining superior adults in connection with the psychological program at the United States Coast Guard Academy, while Felix, Cameron, Bobbitt, and Newman (20) cite the use of a vocabulary test in connection with the examination of Coast Guard cadets. Lewinski (37) refers to the vocabulary test of the 1937 Stanford-Binet as a possible independent measure of mental ability in the examination of naval personnel

Because tests of vocabulary are through necessity strongly dependent on language function, it is to be expected that pertinent investigations would be conducted on the effects of foreign language on such tests Mead (45) examined 43 Italian children with the 1916 Stanford Revision and found that when the level obtained on the vocabulary test was compared with the level attained on the whole scale, the mean difference in favor of the whole scale rating was 28 months. Jones (32) administered List I of the same test to 552 children in a foreign industrial community and found that of the mixed foreign group (excluding American and Jewish cases), only 8.5 per cent attained the expected score for their ages or better She concluded that extreme care must be taken in the evaluation of vocabulary mental age scores of children of foreign parentage and that gross injustices may be done by classifying them on the basis of vocabulary scores alone. Oberlin (48) also warns that the vocabulary scores of children having parents who speak a foreign language may not be used as accurate indices of innate intelligence. With regard to his 1916 Revision, Terman (63) admits that the vocabulary test may not be reliable in the examination of children whose home language is not English. In a later paper, Terman (64) states that among children from Portuguese and Italian homes where a foreign language is spoken, the vocabulary level is for the first two or three years of school life considerably below the median for American children of the same mental age, this difference, however, almost totally disappears by the time the child has attained the mental age of 12 years.

Sex differences do not seem to play a major rôle in success on vocabulary tests, although their influence has been suggested Gansl (21), for example, administered a sentence-type multiple-choice vocabulary test to 1,041 pupils in grades three through eight, and found that between the ages of eight and 14, boys were slightly superior to girls in vocabulary ability, and that the difference, although not reliable, was fairly consistent Feinberg (19), in his study of the individual words of the 1916 Stanford vocabulary test, has indicated that the correct definition of the word "mellow" is influenced by the chronological age of the individual and by the sex to which the individual belongs.

Determination of the effect of socio-economic status on vocabulary was the purpose of the study conducted by Cuff (16), who reports a positive relationship between social status and vocabulary, although this relationship is admittedly slight in view of the low positive correlations (.30, .29, .32) obtained between social status and five-, ten-, and fifteen-minute vocabulary tests

5. *Vocabulary and Mental Deterioration*

The measurement of vocabulary has been fundamental to the construction of measures of mental deterioration, since, as compared with other functions, vocabulary has been noted to be relatively unaffected by deteriorative processes Tests of mental impairment are thus generally found to be based on the premise that the estimation of a patient's vocabulary will provide a fairly valid index of his original intellectual level and that the degree of deterioration may be approximated by comparing his performance on other tests (which are sensitive to the deteriorative process) with this level Hence, the test devised by Babcock (6) is dependent upon a vocbulary test in determining the predeteriorative mental level and subsequently the amount of impairment. The *Shipley-Hartford Retreat Scale* (59, 60), is constructed on the tenets that (*a*) the vocabulary level of the early deteriorating patient is affected relatively slightly, and (*b*) his ability to see abstract relationships declines rapidly A multiple-choice paper-and-pencil vocabulary test is employed in this scale together with a test of conceptual thinking The *Hunt-Minnesota Test for Organic Brain Damage* (27, 28, 29) utilizes the 1937 Stanford-Binet vocabulary test in determining the patient's original mental level

Numerous studies have been published on the value of specific tests of deterioration, and while it is not the purpose of this paper to discuss the merits and limitations of individual tests, the investigations and opinions concerning the validity of the principle on which the tests are based—that of the relative unsuspectability of vocabulary to impairment—are worthy of note

Schafer and Rapaport (55) consider vocabulary to be a "sturdy item" which is generally above the general run of scores in cases with serious pathology, although they admit recognizing the fact that it is also subject to impairment Rapaport (52) contends that vocabulary is usually most resistent to impairment, and thus considers scatter on the Wechsler-Bellevue scale from the standpoint of deviation of subtest scores from the vocabulary level Regarding the same test, Reichard and Schafer (53) believe that since vocabulary has been found to stand up best of all items in cases of deterioration, the vocabulary score is helpful in estimating the original endowment of the subject and in detecting impairment in other functions Cleveland and Dysinger (15) observed fairly consistent scores on the vocabulary subtest of the Bellevue scale in a group of 20 institutionalized senile patients ranging in age from 64 to 83. Wechsler (66) includes vocabulary among the tests in which loss is least marked in old age Hebb (26) points out that vocabulary is retained nearly at a normal level in deterioration (although not completely unaffected) and thus may be used as an index of level of past development Upon examination of 20 individuals between the ages of 55 and 93 with respect to mental efficiency, Beeson concludes that "of all the more important functions, the old people are best by far in vocabulary" (7, p 232)

Investigations and opinions of a negative nature are likewise to be found Landis (36) holds that tests of deterioration which rely upon vocabulary as an index of original endowment are imperfect indicators of degree of deterioration. Capps (13) used seven different types of vocabulary tests in the examination of 80 cases of "idiopathic" epilepsy and 20 normal individuals, and found that mental deterioration in epilepsy involves a general impairment of vocabulary functioning This finding was held to be in contrast to the previously accepted belief that vocabulary tends to remain relatively unchanged by deterioration. Shakow, Dolkart, and Goldman (58) compared two groups of aged psychotic patients with normal subjects and found vocabulary performance considerably disturbed in both psychotic groups beyond what would be expected from age alone Yacorzynski (71), speaking of the Babcock test, believes that since that test makes use of only the end result in the definition of words, the observation that vocabulary remains unaffected by general deterioration is superficial one, and explains the apparent stability of vocabulary in the deteriorated individual in terms of easier methods being left to the organism in reaching the same end result even if the more difficult solutions are no longer available

6 *Vocabulary and Psychopathology*

The literature is rich in informative investigations on the effects of mental pathology on performance on various vocabulary tests This field is particularly important, since if functional consistencies can be determined, it is possible for psychological tests to be of assistance not only in psychiatric differential diagnosis, but in certain cases aid in determining prognoses as well.

Jastak (30) holds that the vocabulary test of the 1916 Stanford-Binet gives the most accurate picture of native intelligence in the majority of cases suffering from mental disorders, and contends that the vocabulary test measures the level of ideational abstractions. Rabin (51) reports that the highest correlations between vocabulary and general intelligence are found among nonpsychotics and the lowest among psychoneurotics He further found that all psychopathological groups showed a greater *IQ* discrepancy (in favor of the vocabulary) than did the nonpsychotics Penrose (50) indicates that high vocabulary scores are characteristic of the psychometric profiles found in psychosis and femininity, which show a certain superficial resemblance to one another

Roe and Shakow (54) compared the performance of 827 state hospital patients (with varying diagnoses) on the 1916 Stanford-Binet test with that of normal subjects, and found that in all groups there was a discrepancy between vocabulary and other scores in favor of the former Among psychotics, this discrepancy was greatest in the schizophrenic In examining groups of schizophrenics, adult delinquents, and normal subjects, Altman and Shakow (1) found that the performance of schizophrenics on the vocabulary test of the 1916 Stanford-Binet was relatively better than that of the other groups when compared with performance on the rest of the test. They suggest that a vocabulary test, separately standardized, might yield a better estimate of mental level than the complete Stanford-Binet test in less cooperative patients, since it receives relatively greater attention and effort Magaret (41) reports that vocabulary is one of the subtests of the Wechsler-Bellevue scale which differentiated between schizophrenics and nonpsychotics, and between paretics and nonpsychotics Using the same test, Magaret and Wright (42), in an investigation of the comparative psychometric performance of mental defectives, hospitalized schizophrenics, and control subjects, found that, as compared to their performance on the scale as a whole, the performance of the schizophrenics and adult morons on the vocabulary test was superior In a study of 200 psychotics (schizophrenics and organic cases) and 100 subnormals, Malamud and Palmer (44), using the short form of the Stanford-Binet scale, found the vocabulary measure positively related to all measures of scatter in the two psychotic groups but not in the subnormal groups, and suggest that some systematic factor may operate among the psychotic patients which is not present among the subnormals. Rapaport (52) states that vocabulary is "profoundly impaired" in neurasthenics, psychotic depressives, and deteriorated schizophrenics, and that the highest vocabulary averages are found in paranoid conditions, over-ideational preschizophrenics, and the obsessive-compulsives.

Wechsler, Halpern, and Jaros (68), in their investigation of insulin-treated schizophrenics, found that tests such as the vocabulary test showed little discriminating value as measures of change in the mental state of the patient before and after treatment. Jastak (31), using the 1916 Stanford-Binet vocabulary test, likewise found vocabulary to be relatively stable among psychotics who were tested before and after insulin shock therapy, and believes that the vocabulary quotients approximate best the true level of the patient's intellect.

Glanville (23), in his study of the psychometric performance of industrial school boys, reports that for the group as a whole, there was no statistically significant differences between vocabulary and Stanford-Binet quotients. Bijou (9), investigating the psychometric similarities between habitual criminals and psychotics, found that recidivists' psychometric patterns characteristically included a high vocabulary *IQ* and that the habitual adult delinquents were psychometrically similar to the psychotics.

Benton and Howell (8) discuss the use of the vocabulary test of the Shipley-Hartford scale in providing a partial index of the pre-traumatic intellectual level of a patient with a post-traumatic personality disorder. Hebb (25) cites the case of a woman with incomplete removal of a large bilateral frontal glioblastoma, who retained a Superior Adult II vocabulary on the Stanford-Binet scale, although her memory for recent events was grossly affected. In a later paper, Hebb (26) contends that vocabulary is depressed by birth injury, but that it is not seriously affected by injury occurring at maturity, except in the case of aphasia.

Among a group of 53 mentally retarded subjects, Bradway (11) found that their average word meaning age (derived from the New Stanford Achievement Test) exceeded the mean mental age by nearly two years. She admits, however, that change factors might have been operating to produce this superiority in vocabulary. Louden (40) compared the performance on the 1916 Stanford-Binet vocabulary test of a group of dull subjects and a group of bright subjects, matched with respect to sex and mental age. Despite the greater chronological age of the dull group, the bright group was found to excell in vocabulary performance whether measured by range of scores, median scores, or mean scores.

Analyzing the performance on the Wechsler-Bellevue scale of 371 native, white, male narcotic drug addicts with a matched group of hospital attendants, Brown and Partington (12) found that the addict group was slightly superior to the attendants with regard to vocabulary, although their reported education was lower. This difference is explained in terms of the more diversified lives led by the addicts.

B. THE PRESENT INVESTIGATION

1. PURPOSE

The primary purpose of the present study is the investigation of the significance of vocabulary from a psychometric standpoint. Specifically, the data will have reference to the relationship between vocabulary, as measured by a standardized vocabulary test, and such variables as age, education, and intelligence as determined by both verbal and performance types of examinations. An additional aim is the establishing of tables from which intellectual levels can be predicted from vocabulary scores by means of regression equations. To ascertain the relationship between verbal and performance measures of intelligence as well as the correlation between these measures and age and education is an incidental object of this study.

2. *Subjects*

The subjects used in this research were 1,000 white males best described as constituting a heterogeneous group similar to that which might be expected from a random sample of the native, white, male population of the United States. Using the term "normal" to describe these individuals is subject to the same qualifications as when this term is employed to designate a random sample of persons taken from the general population. Thus, the present group contained subjects evidencing mild psychiatric disturbances as well as individuals deviating both positively and negatively from what is statistically considered "average" intelligence.

The age range of the subjects was from 17 to 62 years, with a mean chronological age of 25.07 years, $\sigma = 7.02$. Their education ranged from no schooling whatsoever to two years of collegiate graduate study. The median school grade completed was the ninth.

Uncontrolled factors with regard to the selection of subjects included nationality of descent, geographical areas of birth and development, and socio-economic status. It is felt, however, that no significant error has been introduced by these uncontrolled conditions

3 *Technique*

In conjunction with psychological examination, each subject was tested with the complete *Wechsler-Bellevue Adult Intelligence Scale* (67), including the vocabulary subtest The Bellevue scale, especially designed for use with adults, is composed of a verbal test, containing five subtests (Information, Comprehension, Arithmetical Reasoning, Digit Span, Similarities), and a performance test, likewise containing five subtests (Picture Completion, Picture Arrangement, Object Assembly, Block Design, Digit-Symbol). Raw scores obtained from each subtest are transposed into standard or "weighted" scores, so that comparison of performance on the various tests is possible From each scale may be derived a verbal *IQ* and a performance *IQ*, together with a total scale *IQ* which is dependent on function on both parts of the scale. While it is clinically useful to consider both verbal and performance scores, the usual procedure is to place dependence on the total scale *IQ* in final evaluation of an individual's mental status

The vocabulary subtest occupies a position as an alternate test in the entire scale, and when used along with the other 10 subtests is not considered in calculating the final score from which *IQ*'s are derived. It is only when used as a substitute for one of the regular subtests that the vocabulary score contributes to the final score In the present investigation, the vocabulary test was presented as a *supplementary* test and therefore did not contribute to the derivation of obtained intelligence quotients The 42 words

TABLE *A*
THE WECHSLER-BELLEVUE VOCABULARY SUBTEST

1 Apple
2 Donkey
3 Join
4. Diamond
5 Nuisance
6 Fur
7 Cushion
8 Shilling
9 Gamble
10 Bacon
11 Nail
12 Cedar
13 Tint
14 Armory
15 Fable
16 Brim
17 Guillotine
18 Plural
19 Seclude
20 Nitroglycerine
21 Stanza
22 Microscope
23 Vesper
24 Belfry
25. Recede
26 Affliction
27 Pewter
28 Ballast
29 Catacomb
30 Spangle
31 Espionage
32 Imminent
33 Mantis
34 Harangue
35 Chattel
36 Dilatory
37. Amanuensis
38 Proselyte
39 Moiety
40. Aseptic
41 Flout
42 Traduce

comprising the vocabulary test are presented in the accompanying list (Table *A*) They were administered in the order listed and interpreted and scored according to the procedure suggested by Wechsler (67)

4 *Results*

a. Distribution of intelligence Analysis of total scale *IQ*'s reveals a range from 46 to 140, with a mean of 98.50. The median and mode were 100 and 99 respectively, and the standard deviation of the distribution was 17 01 On the verbal scale, the mean was 98 33, the median 99, and the mode 101 The range of verbal scale *IQ*'s was from 50 to 138, and the standard-deviation 16.45 Performance scale *IQ*'s ranged from 37 to 143, with a mean and standard deviation of 98 54 and 16 81 respectively The median was 101 and the mode 106. It will be noted that the means of all three scales are not dissimilar and that the standard deviations approximate one another Also, there is little difference among the three measures of central tendency. The greatest discrepancy was between the performance mean and modal *IQ*'s, which amounted to approximately 6 5 points

The difference of .17 between the mean total scale *IQ* and the mean verbal scale *IQ* has a standard error of .748 and a critical ratio of 227 The difference between the mean total scale and mean performance scale *IQ*'s was 04, with a standard error of .756 and a critical ratio of 053 Between the mean verbal scale and mean performance scale *IQ*'s the difference was 21 This difference has a standard error of .744 and a critical ratio of .282. It will be noted that all of these differences are extremely small and statistically unreliable when judged by their standard errors and critical ratios In 502 cases the performance *IQ* exceeded the verbal *IQ*, and in 463 cases the reverse was true Verbal and performance *IQ*'s were identical in 35 instances.

In Figure 1 is depicted the distribution of total scale, verbal scale, and performance scale *IQ*'s obtained by the 1,000 subjects used in this investigation It will be observed that these frequency distributions follow the same pattern, and that they approximate a normal curve The distributions are not unlike the one found by Wechsler (67) to characterize the performance on the total scale of 1,508 subjects ranging in age from 10 to 60

In Table 1 is found the distribution of total scale *IQ*'s according to clinical classification Grouped according to Wechsler's categories, 43.4 per cent of the subjects are classified as having average intelligence, with an approximately equal percentage (17 0 and 17 6 respectively) being found at the bright normal and dull normal levels. Classified as superior are 6 4 per

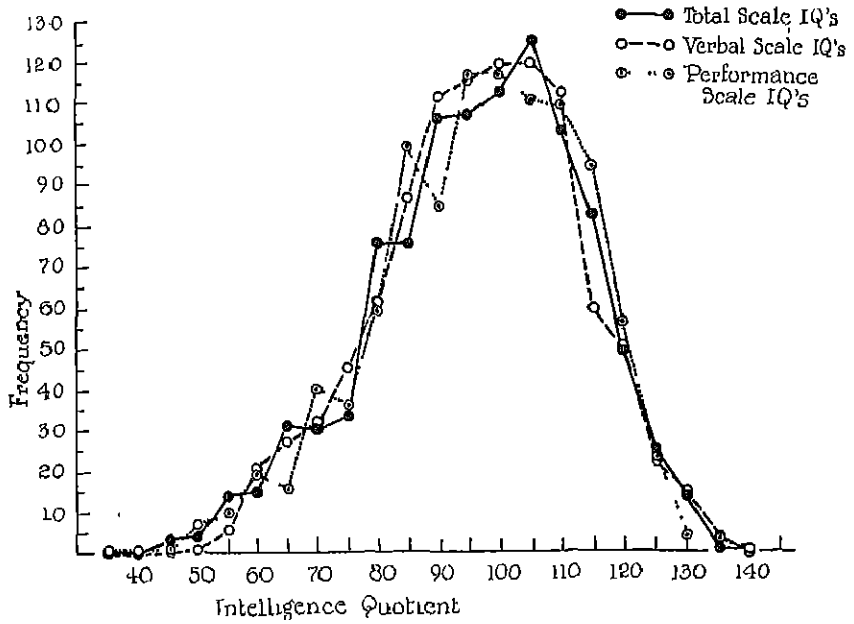

FIGURE 1

Frequency Distribution of Total Scale, Verbal Scale, and Performance Scale *IQ*'s

TABLE 1

Frequency Distribution of Total Scale *IQ*'s According to Clinical Classification

Classification	*IQ* limits	*N*	Per cent	Cumulative per cent
Very superior	128+	26	2.6	2.6
Superior	120-127	64	6.4	9.0
Bright normal	111-119	170	17.0	26.0
Average	91-110	434	43.4	69.4
Dull normal	80- 90	176	17.6	87.0
Borderline	66- 79	89	8.9	95.9
Mentally defective	- 66	41	4.1	100.0

cent, while 8.9 per cent are considered borderline defective. At the extreme ends of the scale, 2.6 per cent are found to be of very superior intelligence and 4.1 per cent are regarded as mentally deficient.

b. Inter-scale relationships. Comparison of the relationships existing among the total, verbal, and performance scales of the Bellevue test is of value, since the adequate sample of subjects used in this investigation should yield valid indices regarding the intercorrelation of functions presumably sampled by these tests. The similarities among the various measures of central tendency and variability have been dealt with previously, hence, the present section will be devoted to the degree of correlation existing among them The coefficients to be reported are all *r*'s resulting from application of the Pearson Product-Moment method of correlation

The coefficient of correlation between the total and verbal scale *IQ*'s is .922, *SE* = 005, and represents the highest degree of relationship found among the three scales. It is obviously a significantly high positive correlation and compares favorably with the *r* of 90± 007 reported by Wechsler (67) to exist between *IQ*'s obtained on these scales A coefficient of 912, *SE* = 005 was found between the total and performance scales Here again is represented a high degree of relationship, and again this coefficient is similar to that of 88±.008 reported by Wechsler The lowest degree of correlation was between the verbal and performance scales. The obtained coefficient of 725, *SE* = 015 nevertheless represents a positive relationship and is only slightly higher than the coefficient of .71± 018 reported by Wechsler It is considerably higher, however, than the coefficient of 34 found by Anderson *et al* (2), between these scales upon comparing the performance of college freshmen (women) selected from the upper levels of intelligence. This coefficient is extremely small and is explained in terms of the homogeneity of the group As such, it can hardly be considered as representative of the relationship actually existing between the scales

The data presented indicate that high positive relationships exist between the verbal and performance scales and the *IQ*'s obtained from administration of the total scale The coefficients must be interpreted in terms of the functions sampled by these tests and also with the fact in mind that the magnitude of total scale *IQ*'s is dependent upon performance on both the verbal and performance scales The coefficients between the verbal and performance scales and the total scale are as high as one would reasonably expect from correlation of two independent tests of intelligence, and the correlation between the verbal and performance scales is as great as one might anticipate in correlating a strictly verbal measure with a performance scale. The important fact is that the present findings substantiate the contention that the same trait or ability underlies success on both verbal and performance parts of the Bellevue scale.

c Intelligence and age. In Table 2 is shown the mean total scale *IQ*'s and standard deviations at the various age levels. It will be observed that no pronounced differences exist among the means, and that with one exception, all are within the normal range The exception is found in the 36-year group, where the mean of 111.66 is slightly above the average category

TABLE 2
MEAN TOTAL SCALE *IQ*'S AT VARIOUS CHRONOLOGICAL AGES

Age	*N*	Mean *IQ*	σ
17	34	96.38	15.10
18	89	92.44	18.20
19	109	94.56	18.40
20	100	99.00	15.15
21	70	97.00	18.20
22	73	100.74	14.05
23	72	96.61	16.55
24	45	99.45	16.55
25	36	97.03	17.80
26	49	102.59	18.95
27	29	99.03	19.05
28	24	103.42	16.05
29	29	101.10	15.20
30	25	100.80	14.70
31	24	100.50	15.55
32	25	99.00	17.50
33	18	96.61	17.30
34	22	105.50	15.45
35	23	94.74	16.50
36	15	111.66	9.10
37	25	101.80	12.65
38	19	103.53	15.85
39	7	98.29	12.86
40-44	23	100.17	14.65
45-49	10	104.90	17.46
50-62	5	104.40	13.05

This is doubtless the result of a sampling anomaly, since among the individuals comprising this group were some with exceptionally high intelligence quotients. Thus, there is no reason to assume that superior intelligence characterizes individuals in the 36-year age bracket generally. The irregularities among the means are not uniform and those variations that do exist undoubtedly represent artifacts rather than true differences. Essentially, the distribution indicates that no marked differences in mean intellectual status can be discerned at the various age levels, and that no uniform advance or decline of intelligence quotients can be observed as the age factor increases.

The coefficient of correlation between the total scale *IQ*'s and chronological age is .131, *SE* = .031, indicating that no relationship exists between age and intelligence quotients obtained on the Bellevue total scale. This finding is somewhat at variance with the correlations reported in previous investigations. Harris and Shakow (24), using the 1916 Revision of the Binet, found a correlation of —.29 between chronological and mental ages among normal subjects. Employing the same test, Weisenburg, Roe, and

McBride (69) report a correlation of —.18 ± .13 between these variables. Miles and Miles (46) found a correlation of .80 ± .023 between age and intelligence among individuals ranging in age from 7 to 17, and a coefficient of —.50 ± .02 among individuals ranging in age from 20 to 95. The above findings must be interpreted in terms of the tests used and the degree to which these tests take the age factor into account. Examinations such as the Stanford-Binet use 15 or 16 as the chronological age for adults in the derivation of intelligence quotients and such a procedure obviously does not compensate for the normal, gradual decline of mental efficiency with age. Thus, older individuals or penalized in so far as intelligence quotient is concerned, and it is to be expected that a negative correlation will exist between age and intelligence quotient when such a technique is employed. The Bellevue scales, on the other hand, take into account this change in mental efficiency with advancing age, and thus *IQ*'s remain relatively stable regardless of chronological age. Hence, a correlation approaching unity might be anticipated between chronological age and intelligence quotients derived from the Bellevue test.

Correlations of similar magnitude are found between age and the verbal and performance scales. A coefficient of .113, *SE* = .031 exists between chronological age and the verbal scale, and between the performance scale and age a coefficient of .126, *SE* = .031 was found. Both these coefficients are subject to the same interpretations as is the correlation found between age and the total scale.

d. Intelligence and education. The mean total scale *IQ's* at the various educational levels are presented in Table 3. It is obvious from this table

TABLE 3
MEAN TOTAL SCALE *IQ*'S AT VARIOUS EDUCATIONAL LEVELS

School grade completed	*N*	Mean *IQ*	σ
0-3	21	78.95	14.45
4	19	78.26	20.05
5	36	80.91	14.75
6	54	85.41	16.00
7	90	88.17	13.60
8	201	94.02	14.40
9	133	98.04	14.45
10	132	103.38	13.30
11	86	103.99	14.60
12	178	109.44	12.70
13	15	113.00	13.05
14	16	118.93	9.05
15	7	118.29	6.23
16+	12	119.08	10.49

that a positive relationship exists between educational attainment and intelligence as measured by the total scale, and that as education increases, so does the magnitude of the total scale IQ's.

The coefficient of correlation between education and the total scale IQ's is .563, $SE = .022$. Between education and the verbal scale the coefficient is .610, $SE = .020$, while a correlation of .440, $SE = .025$ exists between education and the performance scale. From these data may be concluded that the relationship between educational level and the verbal scale is greater than between education and the performance scale or the verbal and performance scales combined. While both are measures of innate intelligence, it is probable that the functions sampled by the verbal tests are more sensitive to the effects of formal education than are those sampled by the performance tests.

In a previous investigation, Weisenburg, Roe, and McBride (69) obtained a correlation of .62±.08 between education and intelligence as measured by the 1916 Revision of the Binet. This coefficient is approximately the same as was obtained in the present study between education and the verbal scale, and is understandable in view of the similarity of functions tapped by these tests. In the interpretation of all correlations between education and intelligence, stress should be placed on the fact that dull individuals tend to drop out of school while bright subjects tend to continue on, and this in itself would account for a positive relationship between the two. This is a more reasonable explanation of the relationship than would be one stressing the effects of formal education in influencing the development and ultimate degree of intelligence.

e. Distribution of vocabulary scores. Like all subtests of the Bellevue scale, the raw scores obtained on the vocabulary test are converted into standard scores when used in the derivation of intelligence quotients. In this investigation, however, only the actual number of words correctly defined will be considered, and this number will constitute the *vocabulary score*. While half credits were given in scoring the definition of individual words as suggested by Wechsler, only whole numbers were employed in the final vocabulary score. Final vocabulary scores ending in half credits were considered in terms of the next whole number, e.g., 16½ = 17, 22½ = 23, etc.

The range of vocabulary scores was from 6 to 40, with a mean and median of 20.84 and 21 respectively. The standard deviation of the distribution was 6.96 and the modal score 18. In Figure 2 is shown the distribution of vocabulary scores obtained by the 1,000 subjects employed in this

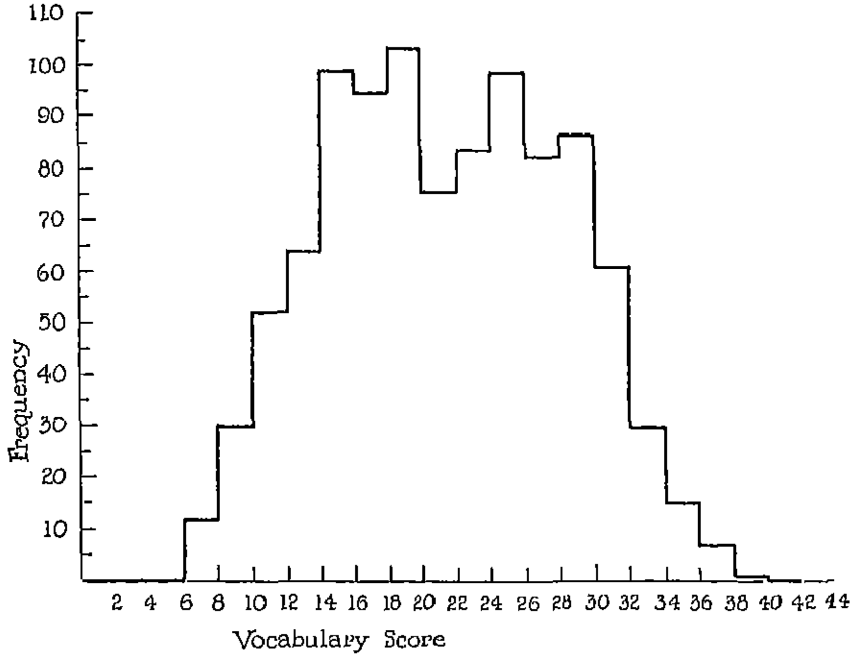

FIGURE 2
FREQUENCY DISTRIBUTION OF VOCABULARY SCORES

study. It will be seen that the histogram presents several irregularities, although its general shape is that of a curve of normal distribution. The irregularities may be attributed in part to the possibility of the words not being listed and hence not presented in the exact order of difficulty—a fact which has been noted in a previous section of this paper.

f. Vocabulary and intelligence. In Figure 3 is shown the relationship between the vocabulary scores and intelligence as measured by the total scale. This line graph evidences a gradual but steady rise in the number of words correctly defined with increasing intelligence, and points to a definite positive relationship between these two variables. This relationship is further demonstrated by the coefficients of correlation existing between them. The highest coefficient (.816, $SE = .011$) was obtained between the vocabulary scores and the total scale *IQ*'s, while a coefficient of approximately the same magnitude (.809, $SE = .011$) was found between the vocabulary scores and the verbal scale. The coefficient of .684, $SE = .017$, found between the performance scale and vocabulary, points to a lesser degree of relation-

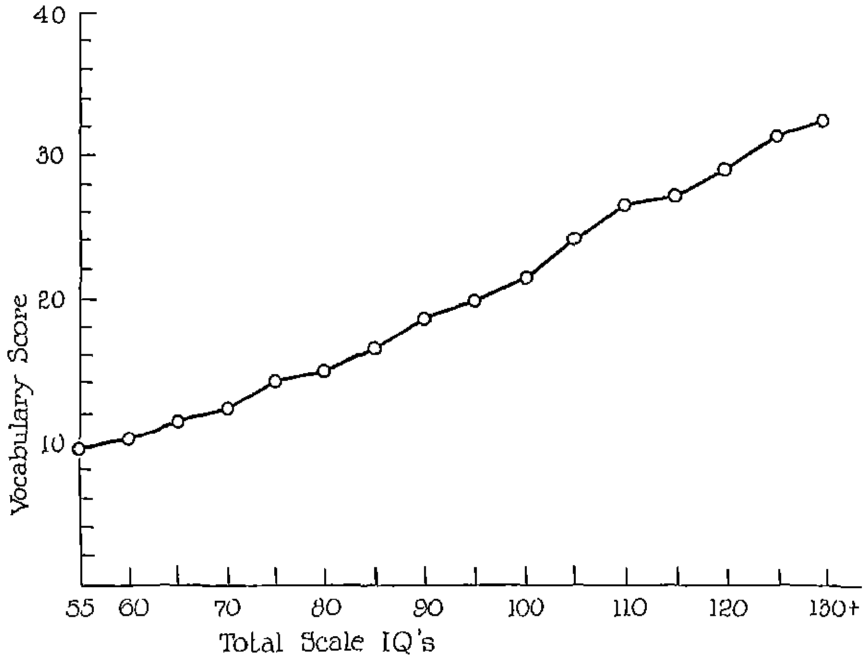

FIGURE 3
RELATIONSHIP BETWEEN VOCABULARY SCORES AND INTELLIGENCE

ship with regard to vocabulary and the performance tests as compared with the verbal tests alone or the verbal and performance tests combined.

The correlations found between vocabulary and the total and verbal scales of the Bellevue test are in keeping with those between vocabulary and general intelligence mentioned in other investigations Terman (64) found a correlation of .91 between vocabulary and mental ages obtained from the 1916 Revision of the Binet among a miscellaneous group of 631 school children With the same test, Mahan and Witmer (43) report a coefficient of .87 between these variables among a group of 269 children In their investigation of adult intelligence, Weisenburg, Roe, and McBride (69) used this revision and found a correlation of 81 between intelligence and vocabulary, while Oberlin (48) reports a coefficient of .94 between the vocabulary test of the 1916 Stanford-Binet and the verbal items of the Merrill-Palmer Preschool Performance Scale.

With reference to the 1937 Revision of the Binet, Terman and Merrill (65) mention correlations between mental age and vocabulary for single age groups ranging from .65 to 91, with an average of 81. Elwood (17), also experimenting with this test, reports a coefficient of 978 between mental age and vocabulary among 1,161 Pittsburg school children White (70) compared the performance of 753 children with regard to success on the 1937 Revision and found a correlation of .86 between the number of words passed on the vocabulary test and mental age Rabin (51) administered the vocabulary test of this revision and the Wechsler-Bellevue scale to 268 psychotic and non-psychotic state hospital patients and found a correlation of 78 between vocabulary and total scale Bellevue *IQ*'s. Wechsler (67) states that the correlation (*eta*) between the Bellevue vocabulary subtest and the total scale is 85 *It will be noted that this coefficient is approximately* the same as the one found in the present study between these variables. The general trend throughout all the studies cited above is toward a marked positive relationship between vocabulary as measured by tests such as are found in the Stanford-Binet and Bellevue scales and general intelligence as determined by these standardized batteries

In an evaluative study of the *Shipley-Hartford Retreat Scale* (59, 60) as an independent measure of mental ability, Lewinski (38) obtained correlations of 577, 635, and 364 between the vocabulary test of that scale and the Bellevue total, verbal, and performance scales respectively. The lesser magnitude of these coefficients when compared with those reported above must be interpreted with the fact in mind that the vocabulary test of the Shipley scale is a group test and is thereby subject to the same limitations as are all tests of the paper-and-pencil variety

In Table 4 can be seen the mean number of words defined according to clinical classification As might be expected from the positive relationship demonstrated between vocabulary and intelligence, greater vocabulary scores characterize the higher clinical classifications. The differences in mean

TABLE 4

MEAN VOCABULARY SCORES ACCORDING TO CLINICAL CLASSIFICATION

Classification	*IQ* limits	*N*	Mean vocabulary score	σ
Very superior	128+	26	31 69	2 90
Superior	120-127	64	29 69	3 92
Bright normal	111-119	170	26 74	4 11
Average	91-110	134	21 33	5 01
Dull normal	80- 90	176	15.82	3 73
Borderline	66- 79	89	12 79	3 69
Mentally defective	- 66	41	9 90	2 65

scores, however, tend to become less at either extreme. Thus, respective differences of 5.41 and 5.51 are found between the average group and the bright normal and dull normal groups, while differences of but 2.00 and 2.89 are to be found between the very superior and superior groups and the borderline and mentally defective groups. With one exception, that being between the superior and very superior groups, all differences between mean number of words defined by the clinical groups are statistically significant. The findings indicate, in general, that vocabulary scores differentiate among the various clinical groups, *that the obtained differences tend to be statistically reliable,* and that these differences evidence a tendency to become less pronounced at both extremes of the scale.

In an effort to compare performance on the vocabulary test with that shown on the entire scale, the individual vocabulary scores were transposed into standard scores so that comparison with other subtests was possible. The standard vocabulary scores were then compared with the mean standard scores obtained on the 10 regular subtests. It was found that of the 1,000 subjects, 458 obtained standard vocabulary scores which exceeded the mean *standard score on all other tests, and that in 521 instances the standard* vocabulary score was less than this mean. In the remaining 21 cases the scores were identical. These data point toward a slight tendency for vocabulary functioning to fall below that evidenced on the entire scale, however, this tendency is not strong enough to permit any general conclusions to be drawn.

g. Prediction of mental level from vocabulary scores. In view of the high degree of correlation that exists between vocabulary and general intelligence, it is reasonable to assume that the latter may be predicted with some degree of accuracy from the former. To this end, regression equations were employed in the present study to determine the "most representative" verbal, performance, and total scale *IQ*'s of vocabulary scores ranging from 6 to 40. The regression equations employed are as follows.

$$X' = 1.99\ Y + 57.03$$

where X' = the total scale *IQ* and Y = the vocabulary score

$$X' = 1.91\ Y + 58.53$$

where X' = the verbal scale *IQ* and Y = the vocabulary score

$$X' = 1.65\ Y + 64.15$$

where X' = the performance scale *IQ* and Y = the vocabulary score

The *IQ*'s predicted on the basis of these formulae are set forth in Table 5. In utilizing these data, it should be understood that they are applicable only

TABLE 5
MOST REPRESENTATIVE *IQ*'S PREDICTED FROM VOCABULARY SCORES

Vocabulary score	Total scale	Verbal scale	Performance scale
6	69	70	74
7	71	72	76
8	73	74	77
9	75	76	79
10	77	78	81
11	79	80	82
12	81	81	84
13	83	83	86
14	85	85	87
15	87	87	89
16	89	89	91
17	91	91	92
18	93	93	94
19	95	95	96
20	97	97	97
21	99	99	99
22	101	101	100
23	103	102	102
24	105	104	104
25	107	106	105
26	109	108	107
27	111	110	109
28	113	112	110
29	115	114	112
30	117	116	114
31	119	118	115
32	121	120	117
33	123	122	119
34	125	123	120
35	127	125	122
36	129	127	124
37	131	129	125
38	133	131	127
39	135	133	129
40	137	135	130

in cases falling within the age range of the subjects used in this study, and that the *IQ* equivalents of vocabulary scores are subject to varying degrees of error. The margin of error can be appreciated in terms of the standard errors of estimate, which are 9.67, 12.25, and 9.83 for the verbal, performance, and total scales respectively. Levels of intelligence cannot be predicted with unfailing accuracy from vocabulary scores alone any more than they can be from any other isolated function. Nevertheless, from the data presented, it is possible to derive an approximation of an individual's mental level from his performance on the Bellevue vocabulary subtest in cases where it is clinically advantageous or necessary to do so. It is also possible to compare the *IQ* derived from the vocabulary subtest alone with that obtained on the entire scale. This should prove useful in determining the possible existence of intellectual deterioration or impairment in accordance with the techniques described in previous subsections of this paper.

This is not the first or only instance of the preparation of tables from which mental levels might be derived from vocabulary function alone Mahan and Witmer (43) presented mental age equivalents for scores on the vocabulary test of the 1916 Revision of the Binet as the result of the application of regression equations. Unlike the present study, their subjects were almost entirely children, with a mean chronological age of 12 7 years A similarity between their investigation and the present one is the finding of a fairly substantial error of estimate which must be taken into consideration in prediction Using the 1937 Revision of the Binet, White (70) published mental age norms for vocabulary scores obtained not by means of regression equations but by determining the average number of words correctly defined at each age level. White's data were obtained from children and include mental age equivalents only for from 5 to 16 5 words correctly defined. She contends that her data may be of use when a sharper differentiation of subjects is desired on the basis of vocabulary than is permitted in the complete scale.

h. Vocabulary and age. The relationship between vocabulary and age must necessarily be considered carefully in terms of the chronological ages of the subjects from whom this relationship is derived, since from an empirical standpoint it is obvious that vocabulary increases during the early years and that it will either show a definite increase in growth throughout adulthood into old age or will cease growth at a particular age level and either remain stationary or evidence a decline with advancing years In Figure 4 is shown the relationship between vocabulary scores and chronological age for the subjects used in this investigation. It will be observed that this line graph shows, with the exception of minor variations which may be due to sampling factors, no well-defined increments or decrements with increasing chronological age These data tend to support the observation that vocabulary function is a relatively stable one, and that there is no marked tendency for it to increase or decrease with chronological age, once its peak level has been attained. In this regard, it is well to compare Figure 4 with the curve of mental growth and decline presented by Wechsler (67). Wechsler's data indicate that the mean standard scores obtained on his test tend to fall off somewhere between the ages of 15 and 22 and that this decline of mental ability can be definitely observed with additional increases of chronological age.

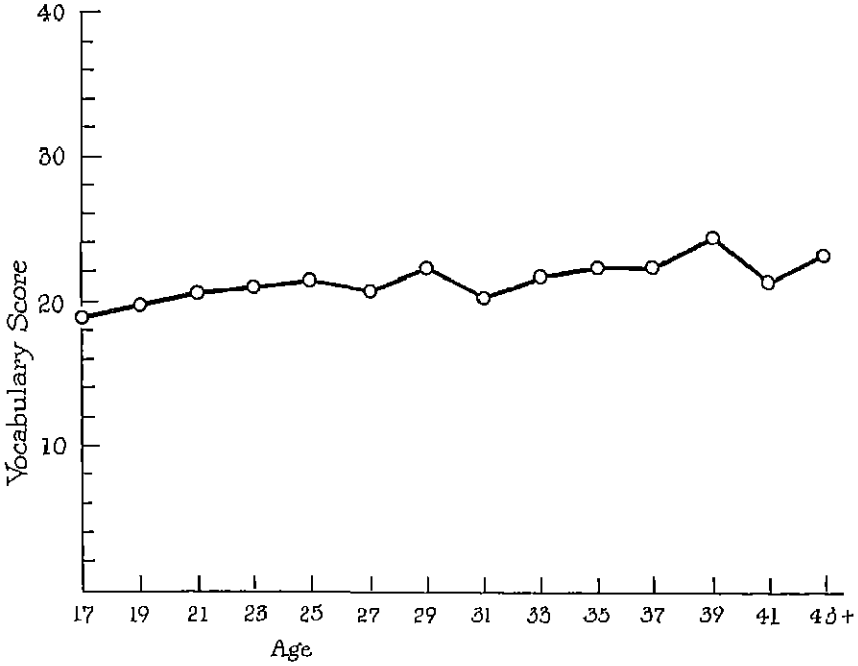

FIGURE 1
Relationship between Vocabulary Scores and Chronological Age

If vocabulary function tends to remain relatively stable while mental functioning in general evidences a decline, it becomes apparent that vocabulary scores can be of practical use in arriving at an individual's original mental level, thus permitting the calculation of the degree of deviation of other functions from this standard.

Experimental data have yielded fairly consistent findings regarding the stability of vocabulary during adulthood, although there is not complete agreement. In accord with the present results is the investigation of Gilbert (22), which offers evidence that general vocabulary does not increase materially after maturity has been attained, as is that of Weisenburg, Roe, and McBride (69), which showed that the abilities sampled by vocabulary tests showed little or no decline through the fifties. Using the Stanford-Binet vocabulary test administered to 203 male and female subjects who ranged in age from 18 to 89, Shakow and Goldman (57) found that vocabulary ability is not affected by age until the seventh decade, at which period it seems to be affected adversely. In disagreement is the investigation of Sorenson (61), which demonstrated a positive relationship between age and vocabulary among adults, since curves for vocabulary ability were found to increase with age. Sorenson contends that it is conceivable for one to acquire a larger vocabulary by living in an intellectually rich environment, although he admits that this increase in vocabulary may not represent real mental growth. A study with somewhat paradoxical results is that made by Christian and Paterson (14), who administered a paper-and-pencil vocabulary test, with a time limit in effect, to 129 adults ranging in age from 40 to 69. A slight but steady decline was observed with respect to vocabulary up to and beyond the age of 60, however, when the speed factor was removed, a reversal in trend appeared, i.e., a definite increase in vocabulary score was noted. The authors conclude that with the speed factor eliminated, it is probable that vocabulary knowledge will be found to remain intact even up to the age of 70.

The lack of relationship between vocabulary and age among adults can be further appreciated in terms of the degree of correlation existing between them. In the present study, the coefficient of correlation between age and vocabulary scores was found to be .168, $SE = .031$. This coefficient, which is negligible in degree, serves to emphasize the lack of positive relationship between these two variables, and is not at marked variance with the coefficients reported in other investigations. Shakow and Goldman (57) report a coefficient of —.10 between age and vocabulary scores of adults on the Stanford-Binet vocabulary test. Miles (47) likewise reports a negative correlation (—.04) between these variables among 400 adults, while Terman and Merrill (65) refer to a study by Green in which a coefficient of .09 was obtained between age and vocabulary scores among a group of 110 adults ranging in age from 19 to 84. Hunt (27) found correlation of .07 between age and scores on the 1937 Stanford-Binet vocabulary test, and Roe and Shakow (54) report a coefficient of .16 between chronological age and vocabulary function on the 1916 Revision.

As might be expected, growth curves of vocabulary with respect to children will vary in character when compared with those of adults. The curve presented in the study of White (70), for example, shows the average number of words defined at various chronological ages up to 14, and increases in vocabulary function are clearly discernible from year to year. Similarly, the age-progress curve for vocabulary found by Gansl (21) in her study of the growth of vocabulary among children between the ages of 8 to 13, is best described as a straight line, with a slight tendency toward negative acceleration between the ages of 12 and 13. Coefficients of correlation between age and vocabulary among children may thus be expected to be both high and positive in view of this demonstrated relationship

1. *Vocabulary and Education* The relationship between vocabulary and education can be seen upon examination of Figure 5, in which is shown the mean vocabulary scores according to the last school grade completed Inspection of this line graph indicates a general trend toward increased vocabulary

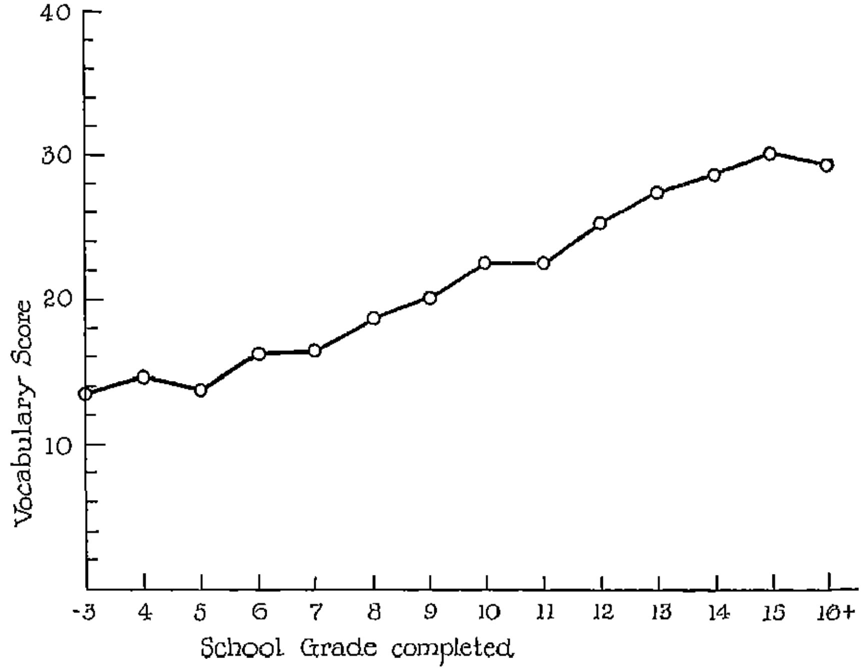

FIGURE 5
RELATIONSHIP BETWEEN VOCABULARY SCORES AND EDUCATION

function with advances in educational attainment, however, there are some minor fluctuations which again may be due to sampling factors The curve showing the gains in vocabulary ability with increased education is not as pronounced as the one showing the growth of vocabulary with general intelligence (cf Figure 3), indicating that while a positive relationship exists between vocabulary and both intelligence and education, the relationship between vocabulary function and the former is the more marked

The coefficient of correlation between education and vocabulary score is .572, *SE* = 021, substantiating the positive relationship between these variables. It is of interest to note that this coefficient is approximately the same as was found between education and the total scale IQ's (.563, SE = .022), and considerably less than that found between vocabulary and the total scale IQ's (.816, SE = .011). Here also is emphasized the fact that *although the relationship between intelligence and vocabulary is greater than* that between education and vocabulary, the relationship of vocabulary and intelligence to education is approximately the same.

The findings of the present investigation with regard to vocabulary and education are not dissimilar to those of previous studies. Using a sentence type multiple-choice vocabulary test administered to a large group of school children in Grades 3 through 8, Gansl (21) reports consistent increases in mean score from grade to grade. Weisenburg, Roe, and McBride (89) found a coefficient of correlation of .49 between education and performance on the Stanford-Binet vocabulary test. Shakow and Goldman (57) report a definite relationship between educational level and vocabulary and found a coefficient of .64 between these variables. However, the authors consider this relationship due almost entirely to the indirect effect of mental level.

The data brought forth in the present study, as well as that reported in other investigations, point toward a positive relationship between education and vocabulary which is not as pronounced as that between general intelligence and vocabulary. The contention that the relationship between education and vocabulary is probably in large part an indirect result of intellectual level is doubtless a valid one, although it is impossible to deny that education in itself is a determining factor in vocabulary growth. The development of vocabulary can be attributed to both general intelligence and scholastic attainment, with the former undoubtedly exerting the greater degree of influence.

C. Discussion

The voluminous literature on the measurement of vocabulary leaves little doubt as to its importance in the field of clinical psychology. That it provides an index to the many phases of an individual's personality structure, as well as mirroring, within limits, the various aspects of his development and mental make-up, can be stated on purely empirical grounds. In the evaluation of vocabulary performance, it is significant, however, to know exactly what type of test was used—whether it was a general or specific type of test, and whether it was orally administered or was of the paper-and-pencil variety. Any conclusions drawn from the caliber of vocabulary function is necessarily dependent upon the kind of test employed.

The popularity of vocabulary subtests in measures of general intelligence can be attributed in large part to their ease of administration and their demonstrated appeal to the subjects tested, not to mention the fact that vocabulary performance alone has been shown repeatedly to correlate well with the results obtained on tests of intelligence in their entirety. An agreement of opinion exists to the effect that a strong positive relationship does exist between extent of vocabulary and general intelligence, and there is ample experimental evidence to support such a point of view.

Vocabulary tests occupy a position of significance in the determination of mental impairment and deterioration, regardless of the fact that some differences of opinion exist regarding the stability of vocabulary function in cases where intellectual efficiency has been adversely affected It is also apparent that vocabulary tests have been of value in the analysis of intellectual deviations in psychopathology. While there is yet much research to be done in this field, definite contributions already have been made Subsequent experimentation should yield considerably more data which will be of even greater importance in the understanding of the many problems involved.

With reference to chronological age, opinion based on research findings seems to support the contention that vocabulary performance, when compared with other intellectual functions, remains relatively stable with advancing age. This fact is of paramount importance in evaluating the rôle vocabulary tests play in the detection of intellectual deterioration in senility. The relation between vocabulary and education is conceded to be the result of both formal schooling and inherent intellectual ability, with the latter probably exerting the greater influence.

The prediction of intellectual level from vocabulary ability alone presents a fascinating problem as does any shortcut to the measurement of mental efficiency *While it has been proven that such prediction* can be made, the margin of error always present in such prognostication must be in each instance evaluated and considered. The danger lies in the fact that too many individuals are seeking for and are willing to accept such shortcuts without being equally willing to observe the limitations that invariably accompany such procedures. In cases where it is necessary or advisable to utilize a single function in the determination of general intellectual level, however, the vocabulary test stands as one of considerable value. Such cases are represented in the examination of individuals who might object to submitting to more extensive tests, as, for example, the testing of the mentally disturbed and delinquents and criminals. Again, such problems may be in many instances represented in the examination of personnel for employment and in the evaluation of the intellectual status of social service clients Needless to say, vocabulary tests, when used for the determination of general mental level, should be entrusted only to one skilled in psychometric procedures and who is in possession of an adequate clinical background. It is only then that the maximum results possible from the administration of a vocabulary test will be assured.

D Summary and Conclusions

The purpose of the present study was the investigation of the significance of vocabulary from a psychometric standpoint The relationship between vocabulary, as measured by a standardized vocabulary test, and such variables as age, education, and intelligence, determined by both verbal and performance types of examinations, was subjected to quantitative analysis The prediction of intellectual level from vocabulary performance was an additional object of the study The relationship between verbal and performance measures of intelligence, as well as the correlation between these measures and age and education, was also investigated.

One thousand white males, best described as constituting a heterogeneous group similar to that which might be expected from a random sample of the native, white, male population of the United States, were used as subjects Their age range was from 17 to 62 years, with a mean chronological age of 25 07 years Educational attainment ranged from no schooling to two years of collegiate graduate study, the median school grade completed being the ninth

Each subject was examined with the complete *Wechsler-Bellevue Adult Intelligence Scale,* including the vocabulary subtest The number of words defined from this subtest was considered the vocabulary score, and was employed as the criterion of vocabulary ability Analysis of performance on the Bellevue scales revealed a range in total scale *IQ*'s from 46 to 140, with a mean of 98.50 Verbal scale *IQ*'s ranged from 50 to 138, the mean being 98 33 On the performance scale, the mean *IQ* was 98 54, with a range of from 37 to 143 The distribution of *IQ*'s from each scale approximated a curve of normal distribution. When grouped according to clinical classification, 2 6 per cent of the subjects were found to be very superior, 6 4 per cent superior, 17 per cent bright normal, 43 4 per cent average, 17.6 per cent dull normal, 8.9 per cent borderline defective, and 4 1 per cent mentally deficient Vocabulary scores ranged from 6 to 40, the mean number of words defined being 20 84. The frequency distribution of vocabulary scores followed that of a curve of normal distribution. Analysis of data yielded the following results·

1 No statistically significant differences were found among the mean *IQ*'s obtained on the total, verbal, and performance scales. In 502 cases the performance *IQ* exceeded the verbal *IQ* and in 463 cases the reverse was true *Verbal and performance IQ's were identical in 35 instances*

2 High positive relationships were found to exist among the three scales. The coefficient of correlation between the total scale and the verbal scale was 922, between the total scale and performance scale 912, and between the verbal scale and performance scale .725.

3. No marked differences in mean *IQ* were found at the various chronological age levels, and no uniform increase or decline was observed with advancing age The coefficients of correlation between chronological age and the total, verbal, and performance scales were 131, 113, and 126 respectively

4 Intelligence was found to bear a positive relationship to educational attainment Respective coefficients of correlation between the total, verbal, and performance scales and education were 563, 610, and 440

5 Vocabulary scores were observed to become greater with increases in intellectual level. A coefficient of correlation of 816 was obtained between vocabulary scores and the total scale, while coefficients of 809 and 684 were found between vocabulary scores and the verbal and performance scales

6. When the subjects were grouped according to clinical classification, the differences among the mean vocabulary scores obtained by them were found, with one exception, to be statistically significant These differences evidenced a tendency to become less pronounced at both extremes of the scale.

7 When vocabulary scores were transposed into standard scores, the standard vocabulary score was less than the mean standard score obtained on all other subtests in 521 cases, while in 458 cases the reverse was true This pointed toward a slight tendency for vocabulary function to fall below that shown on the entire scale, although this trend was not marked to the degree to permit generalization.

8 By means of regression equations, tables were formulated permitting the estimation of total, verbal, and performance scale *IQ*'s from vocabulary scores The magnitude of the standard errors of estimate, however, emphasized the need of prudence in making such prediction.

9 Vocabulary was found to be a relatively stable function in adulthood,

with no well-defined increments or decrements of vocabulary scores being observed with advancing chronological age. The coefficient of correlation between age and vocabulary scores was .168

10. A positive relationship between vocabulary and education was observed, although it was not as pronounced as that found between general intelligence and vocabulary. The coefficient of correlation between educational attainment and vocabulary scores was 572.

A review of research pertaining to the significance of vocabulary and a discussion of the importance of vocabulary measurement in clinical psychology were presented

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CHILDREN WITH INFERIOR SOCIAL HISTORIES, THEIR MENTAL DEVELOPMENT IN ADOPTIVE HOMES*

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A. STATEMENT OF PROBLEM

The problem of the mental development of children whose social histories are known to be inferior but who experience the familial environment for only a short time or not at all has important implications in the field of child care and placement. If knowledge of the occupational and intellectual status of true parents makes possible the reliable prediction of a child's mental level, the placement problem is essentially one of selecting a home or institutional environment geared to that level If, however, such data have questionable predictive value and then only within wide limits, and if mental development is influenced appreciably by the environment, the emphasis shifts to a consideration of the qualities of the foster home.

Studies of children placed in infancy in adoptive homes have uniformly reported average or superior intelligence as the group level [1] However, these investigations have not been limited to a consideration of the children whose social histories were selected for inferiority While the social status of such groups has in general been inferior, there have been included some cases above that level and some cases of doubtful classification

The purpose of the present study was to investigate the mental development of a group made up exclusively of children selected on a basis of inferior social histories and placed in adoptive homes in infancy, or under two years of age

B PROCEDURE

Three groups of children meeting specified requirements of inferior social histories were selected from the larger population of children from the Iowa Soldiers' Orphans' Home placed in adoptive homes Group I was composed

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[1] Mean *IQ*'s reported in the major studies in the field are *107 4* for Burks' group (1) of 214 children tested at 8 years, 110 0 for Leahy's group (4) of 194 tested at 9 years, 3 months; 111 5 for Skodak's group (6) of 154 tested at 4 years, 4 months, and 101 7 for the 175 children in Freeman's group (2) who were placed under the age of two years The studies of children in adoptive homes should not be confused with those children in boarding homes where adoption is not planned.

of children whose mothers had been classified as mentally retarded on standard tests of intelligence, with *IQ*'s of 75 or less. Group II was made up of children whose putative fathers were inferior in occupational status, classifying as unskilled or slightly skilled laborers, on a basis of the scale devised by Goodenough and based on the occupational classification of employed males in the United States (3) Group III was limited to children who met the requirements for inclusion in both of the preceding groups, the mother was known to have an *IQ* of 75 or less and the father was known to classify occupationally not above slightly skilled laborer. This group consists only of the cases which appear in both Groups I and II and represents the total amount of overlap between these groups All cases meeting the specified criteria for inclusion in the above three groups have been accounted for in this study.

As a preliminary step in the selection of cases meeting the requirements of the above three groups, the files of the Iowa Soldiers' Orphans' Home were checked for the eight-year period from January 1, 1930, to December 31, 1937, in order to obtain a list of children who (*a*) were of white, non-Jewish parentage, (*b*) were committed to the orphanage when less than six months of age, and (*c*) were placed in adoptive homes when less than two years of age

The Iowa Soldiers' Orphans' Home is a state institution for dependent and neglected children, and is operated under the Iowa Board of Control of State Institutions This institution is obligated to accept all infants whose admission is sought, up to its capacity, regardless of the social background of the parents. As a result, the institution frequently admits babies whom private child-placing agencies will not accept because of family background As wards of the Iowa Board of Control of State Institutions, the infants in this study were available for adoptive placement, legal rights of the parents having been relinquished prior to admission to the orphanage

Information regarding both true and foster parents was obtained from the confidential files of the Iowa Soldiers' Orphans' Home The sources from which the true histories were obtained include the mother, the social worker or other responsible person in the community, and reports from hospitals, clinics, schools, physicians, and attorneys. Evaluation of foster homes was based on information found in the foster parents' application for a child, the statements of their referents, and in the reports of the worker approving and supervising the home.

In all but two cases, intelligence test scores of true mothers are based on the 1916 Stanford Revision of the Binet with a maximum of 16 years as the divisor in calculating the *IQ* For the most part these tests were not given by the same psychologists who tested the children

Since January, 1934, *all children for whom adoption was sought have been* given intelligence tests by the Division of Psychological Services of the Iowa Board of Control of State Institutions, all tests being administered by trained and experienced psychologists Three types of individual tests have been used the 1922 Kuhlmann Revision of the Binet, the 1916 Stanford Revision of the Binet, and the 1937 revision of the Stanford-Binet (Form *L* in all but two cases). Until the latter part of 1937 the general procedure was to give the Kuhlmann to children under three and one-half years of age and the 1916 Stanford to children above that age, although some exceptions occurred. Since 1937 the most recent revision of the Stanford-Binet has generally been substituted for the 1916 revision except in cases of children included in a longitudinal study started prior to that time, which group consistently has been given the 1916 revision (6)

Children adopted before the testing program became effective in 1934 and children whose foster parents have not sought to complete adoption were not included in the routine testing program However, most of these children have been tested as a part of a cooperative research program of the Iowa Child Welfare Research Station and the Iowa Board of Control Because of the length of time which had ensued since placement of some of these children it was not possible to locate and test all of them before the close of the study. However, a comparison of factors characterizing the histories of the tested and untested children indicates that the tested group may be considered representative

Since this was not planned as a longitudinal study and repeated tests had not been given to all of the children, only one test on an individual child has been considered in the analysis. If more than one examination was given, the test at the oldest age has been used, with the exception of three children who were removed from foster homes and returned to the orphanage In these, the test nearest the date of removal from the foster home was used

C Group I Mental Development of Children Whose Mothers Have Low *IQ*'s

A total of 107 children met the criteria for inclusion in this group All were committed to the orphanage when less than six months of age and placed in adoptive homes when less than two years old Approximately eighty per cent were illegitimate

1. *True Parents*

Mothers of all children had been tested and none had *IQ*'s higher than 75, the range extending downward to 32. All but two mothers in the group had been given the 1916 revision of the Binet. Both of these were confined in state institutions, and mental retardation was indicated in one case by an *IQ* of 67 on the Wechsler-Bellevue Performance Scale, and in the other by an *IQ* of 70 on the 1911 Goddard revision of the Binet. The children were included in the study, but the scores of the mothers have not been used in the computations of central tendency and variability for the parent group, nor in the correlations involving true mothers' *IQ*.

All but 20 of the children had been tested at the close of this study in November, 1940. When the social histories of the true parents of these 20 children are compared with the histories of the tested children, the two groups are found to be roughly comparable although the true histories of the untested group are slightly superior on a basis of some of the measures used for evaluation. Only one child whose mother rated below 50 had not been examined and only five of the mothers of the untested children had *IQ*'s of 60 or below, although 35 per cent of the entire group were below that level. The comparison of the histories of the tested and untested children appears in Table 1.

TABLE 1

Factor in history	Tested group No	Mean	Median	Untested group No	Mean	Median
True Mother *IQ*	86*	62.7	63.0	19*	64.2	67.0
True Mother Ed.	79	7.0	8.0	19	7.3	8.0
True Father Ed	28	8.4	8.0	6	11.2	11.5
True Father Occ	41**	6.2	7.0	8	5.6	6.0
Foster Mother Ed	74	11.1	12.0	17	9.9	10.0
Foster Father Ed	72	10.8	10.0	17	10.8	11.0
Foster Father Occ	86	4.1	4.0	20	4.0	4.0

*The mother of one child in the tested group was examined on the Wechsler-Bellevue test, the mother of one child on the untested group was examined on the Goddard revision of the Binet.

**Four fathers employed on the farms of relatives were not included in the computations.

Education is represented by the grade completed in school, e.g., 7 represents seventh grade completed. The occupational classification used in this study is that devised by Goodenough (3) and based on the occupational classification of employed males in the United States. This is a seven-point scale ranging from I, professional occupations to VII, unskilled laborers of all types

2. *Foster Parents*

In contrast to the homes of true parents, the foster homes were selected in general for their adequate adjustment in the community. Usual comments describe the foster parents as intelligent, dependable, and stable. The occupational level of the foster homes was higher than the level found among the true fathers of the children. However, it was not as high as that usually found when the foster children are not specifically selected because of inferior social histories. The mean occupational level was 4.1 with a median of 4.0 or about one category below that reported by Skodak (6). The level was above that reported for the population as a whole, 35 per cent of the foster fathers being employed in the three highest levels in comparison with 23 per cent for the population as a whole (3). Educational achievement for foster mothers of children who had been tested showed a mean of 11.1 grades completed with a median at Grade 12, and for foster fathers 10.8 and 10.0 respectively.

3. *Mental Level of the Children*

The mean age of the children at time of placement in foster homes was 5.3 months (median 3.9), with a range from 8 days to 23 months, 8 days. Sixty-seven per cent of the group were placed in foster homes under six months of age. At time of examination, the mean age of the children was 5 years, 5.4 months, with a median of 6 years, 2 months, and a range from 1 year, 1.2 months to 10 years, 6 months.

The mean *IQ* of the 87 children was 105.5. Only four children in the entire group classified below the dull normal group, with *IQ*'s of less than 80, in contrast with 15 who classified as superior with *IQ*'s above 120. Chronological age, mean *IQ*, standard deviations, and range, by test and for all tests are presented in Table 2. The differences in performance on the different tests were not statistically significant.[2]

When the group as a whole was considered, children's intelligence was positively related in terms of a correlational relationship to the intelligence of the true mother, the coefficient of correlation being .23, significant at the five per cent level of confidence.[3] In terms of the relationship on the differ-

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[2] Significance of differences throughout the study is read from a table showing the distribution of "*t*" scores given by Lindquist (5), differences which are not significant at the 5 per cent level of confidence are considered not significant.

[3] Significance of correlation coefficients is based on the tables for small samples given by Lindquist, correlations not being considered significant at less than the five per cent level of confidence.

TABLE 2

Test used on children	*N*	Chronological age, months	Mean *IQ*	*SD*	Range
All tests	87	65 4	105 5	16 7	55-141
Kuhlmann-Binet	32	25 5	106 1	18 4	55-141
1916 Stanford	33	80 8	107 2	13.4	83-132
1937 Stanford	22	100 2	102 2	18 0	68-139

ent tests the correlation was significant only in so far as the children having Kuhlmann tests were concerned, the correlation was 49, significant at the one per cent level

Correlations between children's intelligence, true mother's *IQ* and foster mother's education are shown in Table 3.

TABLE 3

Test used on children	*N*	Correlation with True Mother's *IQ*	Correlation with Foster Mother's education
All tests	87	r 23	r 12
Kuhlmann-Binet	32	r 49	r —06
1916 Stanford-Binet	33	r 16	r 22
1937 Stanford-Binet	22	r —05	r 35

Children's intelligence was not significantly related to the education of the foster mother on any of the tests, although there appeared to be a tendency for an increase in the relationship with an increase in the age of the children

In terms of coefficients of correlation, there was no significant tendency for selective placement based on the relationship between foster mother education and true mother's intelligence or education The correlations were positive (08 between true mother *IQ* and foster mother education and 16 between true mother and foster mother education), but were not significant

When the children were grouped according to the occupational level of the foster home a 4-point difference favored children in the homes more superior occupationally The mean *IQ* of 32 children in homes in the three upper levels was 108 6 (*SD* 13 3) and the mean of 54 children in homes in the four lower levels was 104.2 (*SD* 18 0) [1] The difference was not statistically significant. (Corresponding *IQ*'s of the true mothers were 62 8 and 62 7)

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[1] Occupation of one foster father was unknown

D GROUP II MENTAL DEVELOPMENT OF CHILDREN WHOSE FATHERS HAVE LOW OCCUPATIONAL STATUS

Occupational level has been used as a rough measure of intelligence in popular thinking and to some extent in scientific investigations Most of the scales for classifying occupations are based at least in part on the assumption that varying degrees of mental achievement characterize different occupational levels Although there is wide variation within each occupational category, there has been general agreement in finding a progression in the group level of the intelligence of children in their own homes upward from the unskilled labor group to children of professional workers

Whether this trend is because of a basic inferiority of persons in the lower occupational levels which is transmitted to their offspring, or is conditioned to a large extent by lack of environmental stimulation found in homes in the lower occupational levels cannot be determined by a study of children living in the homes of their own parents The purpose of this section is to consider experimental evidence supplied by a study of the development of children whose fathers are at the low end of the occupational scale when these children are not reared in the familial environment Since in many studies of foster children adequate paternal history is often lacking, the objectives in the selections of this group have been to include only those upon whom information on the father's occupation was available and limited to the inferior levels After cases had been excluded in which a question had been raised regarding the paternity of the father or the information regarding him, 133 cases were found in which the father was classified as an unskilled or slightly skilled laborer, on the scale devised by Goodenough (3) Of these, 111 had been tested when the study closed

1. *True Parents*

Children in this group were selected for study because the occupational status of their fathers was known to be below the average level of the general population, all of them being unskilled or slightly skilled laborers Additional evidence that the fathers as a group had inferior social status was supplied by supplementary information regarding education and standing in the community

Mean occupational status of the fathers of children who had been tested was 6 8 with a median at 7 0 Eighty per cent were classified in the lowest occupational category Most of the common laborers in this group were dependent upon odd jobs or casual farm work, and the records indicated that many had never had steady employment. Educational data in terms of reported grade completed were available on 76 of these fathers, the mean being 8.7 and median 8.0.

Analysis of the information available regarding the mothers of the tested children indicates that as a group they are representative of a downward selection of the population in terms of intelligence, education, and other factors relating to social status. This inferiority, however, is not as marked or as uniform as in Group I. Intelligence test scores were available for 75 of the mothers whose children have been examined. The mean *IQ* was 77.8 and the median 79.5 with a range from 40 to 110. Education was reported for 99 of the mothers of tested children with a mean of 8.6 and *median at 8.0*.

2. *Foster Parents*

The foster homes in this group were markedly superior to the homes from which the children issued and were somewhat superior to the homes of the children considered in the preceding section. Less than 9 per cent of the foster fathers were classified in the lowest occupational categories whereas all of the true fathers were in those levels.

A comparison of the histories of the tested children with the histories of the untested group shows only minor differences on a basis of the factors considered although the histories of the untested children tended to be slightly superior. The children of all mothers with *IQ*'s of 50 or less had been tested, whereas the children of two of the five mothers whose *IQ*'s were over 100 had not been tested. The proportions in the other *IQ* levels were roughly the same for the tested and untested groups. The comparison of the true and foster histories of the tested and untested children is shown in Table 4.

TABLE 4

	Tested group			Untested group		
Factor in history	No	Mean	Median	No	Mean	Median
True Mother *IQ*	75	77.8	79.5	14	81.5	80.0
True Mother Ed	99	8.6	8.0	17	9.2	9.0
True Father Ed	76	8.7	8.0	12	8.8	8.0
True Father Occ.	111	6.8	7.0	22	6.2	7.0
Foster Mother Ed	102	11.3	12.0	20	11.7	12.0
Foster Father Ed.	102	11.4	12.0	29	11.5	12.0
Foster Father Occ	110	3.6	4.0	22	4.0	4.0

3. *Mental Level of the Children*

The children in this group were placed in foster homes at a mean age of five months, the median was 3.3 months and 71 per cent of the children were placed when less than six months of age. The range extended from 8 days to 21.6 months. Mean age at time of examination was 5 years, 1.5 months and the median was 5 years, 10 months.

For the entire group of 111 children the mean *IQ* was 110.3 and the median 110.0. Only two children tested below 80 in contrast to 28 children having *IQ*'s above 120. Chronological age, mean *IQ*, standard deviation, and range by tests are presented in Table 5.

TABLE 5

Test used on children	*N*	Chronological age, months	Mean *IQ*	*SD*	Range
All tests	111	61.5	110.3	15.5	55-154
Kuhlmann-Binet	45	23.1	113.4	17.2	55-141
1916 Stanford-Binet	46	85.9	108.2	11.9	83-129
1937 Stanford-Binet	20	91.4	107.5	17.7	82-154

When the child's *IQ* was correlated with the *IQ* of the true mother in the 75 cases in which the *IQ*'s of both the true mother and child were known, the resulting Pearson product-moment coefficient of correlation was .221. (For significance at the 5 per cent level, a correlation of .227 is required.) When analyzed according to type of test, the correlation of child's *IQ* with true mother *IQ* was significant only on the Kuhlmann test, the coefficient of correlation was .31, which is significant at the 5 per cent level. On the two Stanford revisions, the correlations lacked statistical significance, the correlations being .23 on the 1916 Stanford and .05 on the 1937 Stanford.

For the group as a whole, and on a basis of different tests there was not a significant relationship between the intelligence of children and education of foster mothers. For the entire group the coefficient of correlation was —.07. The correlations on separate tests ranged from —.25 on the Kuhlmann to .43 on the 1937 Stanford, with a correlation of —.01 on the 1916 Stanford.

There was no selective placement as evidenced by the correlation between the education of the true and foster mothers. All correlations were very low, ranging from —.07 on the Kuhlmann to .03 on the 1937 Stanford, with the coefficients of correlation for the entire group being —.03. Comparison of the children in foster homes in the three upper occupational levels with those in homes in the four lower levels revealed a 10-point superiority in mean intelligence quotient in favor of the children in homes in the higher levels. The mean for the 50 children placed in homes in the upper levels was 116.0 (*SD* 13.8), for 60 children in the homes rating lower occupationally, the mean was 105.9 (*SD* 15.3).[5] The difference is statistically significant at the one per cent level (Fisher's "*t*" 3.58.)

However, children were placed selectively when true mother *IQ* is considered in relation to occupational level of foster home. Intelligence quotients known for the mothers of 32 tested children in homes in the upper occupational levels showed a mean of 82.1 (*SD* 13.3). The mean *IQ* of 42 mothers of tested children in homes in the lower occupational levels was 75.0 (SD 15.7) The difference is statistically significant

E. GROUP III: MENTAL DEVELOPMENT OF CHILDREN WHOSE MOTHERS ARE MENTALLY RETARDED AND WHOSE FATHERS HAVE LOW OCCUPATIONAL STATUS

If the social background of only one parent is definitely known to be inferior, the possibility exists that this inferiority may be offset by factors in the history of the other parent. The present section is concerned with the mental development of children in adoptive homes where both the maternal and paternal histories are known to be inferior according to specified criteria. The group consists only of the cases which appear in both Groups I and II, and represents the total amount of overlap between these groups The mothers of all children in this group are known to have *IQ*'s of 75 or less, and all of the fathers have been classified as unskilled or slightly skilled laborers

Thirty-five children met these criteria, 31 of these had been examined As in the other groups there were no significant differences between the histories of the four untested children and the tested group, so only the tested group is reported on Mean age at time of placement was 4 months, 13 days and the median 2 months, 23 days Sixty-five per cent were placed in foster homes when less than six months of age Mean age at time of test was 5 years, 3.4 months, with a median of 6 years, 7 months.

1. *True Parents*

Mean *IQ* of the true mothers was 62.6 with a standard deviation of 8.6 The median was 64.5, and the range was from 40 to 75 Education was reported in 27 cases, the mean being 7.0 and the median 8.0

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[5] Occupation of one foster father was unknown.

All but seven of the true fathers were in the lowest occupational classification, making a mean level for the group of 6.8. School attainment was reported in 18 cases, mean grade completed was 7.4 and the median 8.0.

2. *Foster Parents*

As in the other groups the foster homes present a contrast with the true family histories of the children. Completion of the eighth grade was the lowest educational level achieved by any foster mother, and the range extended upward to college graduation. Only two foster fathers were reported as having less than eighth grade education, and the level extended to graduation from college. Mean education for foster mothers was 11.0 with a median at 12.0. For foster fathers the mean was 10.7 with a median of 10.0. Occupationally, the level of the foster homes was markedly above that of the true fathers and somewhat above the population as a whole, with a mean of 3.8 and a median of 4.0.

For the entire group of 31 children, the level of intelligence was slightly above average with a mean *IQ* of 104.1 and a median of 104.0. Differences between types of tests were not statistically significant. Mean age at time of tests was 5 years, 3.4 months with a median of 6 years, 7 months and a range from 1 year, 1.2 months to 10 years, 6 months. Results according to tests are given in Table 6.

TABLE 6

Tests used on children	*N*	Mean *IQ*	*SD*
All tests	31	104.1	15.9
Kuhlmann Binet	10	106.2	19.8
1916 Stanford-Binet	13	103.4	11.6
1937 Stanford-Binet	8	102.5	16.3

The Pearson product-moment coefficient of correlation between the intelligence of the children and their true mothers was .12, and the corresponding correlation of children's intelligence with education of the foster mothers was .16. Neither of these correlations is statistically significant. There was no evidence of selective placement in terms of the relations between education of true and foster mother or between education of foster mother and *IQ* of true mother ($r = .02$).

A comparison of the mental development of children in relation to occupational level of foster homes shows the same trend found for Groups I and II, 10 children placed in homes in occupational categories I to III had a mean *IQ* of 110.1 (*SD* 12.6), and 20 children in homes in occupational levels IV through VII a mean *IQ* of 102.5 (*SD* 17.5). The difference of

7.6 is not statistically significant. There was a tendency for children of duller mothers to be placed in homes which were lower occupationally, with a statistically insignificant difference of 5.6 *IQ* points between the mothers of the two groups of children.

F. Summary and Conclusions

The purpose of the study was to investigate the mental development of children with known inferior social histories who were placed in adoptive homes in infancy. Three groups were studied: one group of 87 children whose mentally retarded mothers had intelligence quotients of 75 or less; a second group of 111 children whose fathers were unskilled or slightly skilled laborers, and a third group of 31 children who were overlapping in both of the above groups, their mothers being mentally retarded and their fathers being classified low occupationally.

Conclusions may be summarized as follows:

1. Children of mothers with low intelligence or from fathers with low occupational status or from a combination of both, placed in adoptive homes in infancy, attain a mental level which equals or exceeds that of the population as a whole.

2. The frequency with which cases showing mental retardation appear is no greater than might be expected from a random sampling of the population as a whole, and the frequency with which cases having superior intelligence appear is somewhat greater than might be expected from a random sampling.

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EDUCATION FOR INDEPENDENT THINKING: AN ATTEMPT*

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A. INTRODUCTION

By independent thinking is meant here a tendency to analyze all important statements or propositions in order to estimate their truth or degree of probability. Even in the best educated communities many expressions of superstition, prejudice, and misconceived generalizations circulate. The two latter are by far the most dangerous and are widely used for political and other kinds of propaganda. Most people in Denmark are able to recognize superstition as such, but wide-sweeping generalizations—when put forward by people of prestige—and prejudices are often accepted as truths and acted upon accordingly.

In a democracy, where people to a certain extent are expected to choose their political attitude by weighing the value of conflicting arguments, so that their choice is not made just in accordance with the most aggressive propaganda, it is of the utmost importance that independent thinking in the above mentioned sense be encouraged. In fact, it might prove a vaccination against the disease of demagoguery, for which a crisis-stricken, unenlightened democracy might be an easy prey.

Some doubts as to the possibility of educating the common people even to some degree of independent thinking has been voiced. This study is an attempt to measure the effect of a short course in independent thinking on Danish unemployed workers.

B. PROCEDURE

This investigation was made in the Fall of 1943 at The International People's College, Helsingør, Denmark. This college, which before and after the war has had an international curriculum and is visited by students from all over the world, had during the German occupation of Denmark some courses for unemployed Danish workers.

The college gives instruction along the lines of the Danish folk high schools, stressing lectures, study circles, discussion groups and classes ("the

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living word") in foreign languages and cultural subjects such as economics, international relations, social psychology, philosophy, and literature at a primary level. No examinations are passed, the students only receiving a testimonial at the end of the term

In the experiment, which lasted one month, 34 unemployed workers took part, but only 27 subjects attended all the sessions, so that the results are based upon the findings from these students These had all had elementary school training, and about half of them had received vocational training, too They cannot be said to represent the average Danish working man in all respects as most of the unemployed who go to such colleges are more eager to educate themselves than the average workers are

None of the students had any knowledge of philosophy or scientific thinking before they entered the college. Unfortunately only 18 wanted to be given intelligence tests, and those who did placed themselves within the normal range (*IQ* 85-115) except for one who had an *IQ* of 80 only. Another student who was intelligence-tested later had an *IQ* of 120 So in this respect it is most likely that the sample was representative for the Danish working man

First of all the students answered the questions shown in Table 1 containing 10 expressions of superstition and 15 expressions of prejudice and misconceptions.

The short course in independent thinking consisted of three lectures with demonstrations lasting 50 minutes each with an interval of one week between each lecture The lectures stressed the following points

(*a*) Always start by making quite clear what you yourself and what other people are talking about, define all important statements before you enter into a discussion

(*b*) Distinguish between the three kinds of propositions, (*a*) logical propositions which are, in fact, tautologies, (*b*) empirical propositions which may be more or less probable but never absolute truths, and (*c*) nonsense sentences which are neither tautologies nor empirical statements.

(*c*) Beware of making statements about things you have experienced, because of the imperfection of your senses

For Points *a* and *b* the arguments of A J Ayer *Language, Truth, and Logic* (London V Gollancz, 1936) were followed, and the elaboration of the third point was based upon a book of a Danish psychologist on the fallibility of our sense impressions, P. Mahnsen *"Vidnendsagnets Upaalideligbed"* (Copenhagen. Poul Branner, 1936). All three points were amply illustrated by examples and discussions with the students

One week after the last lecture the questionnaire was administered again, the only difference from the first time of presentation being that it was arranged in reverse order. The 25 statements of the questionnaire were all expressions of superstition or misconceptions and prejudice which the author had noticed amongst Danish college students. The method of measuring the effects of the course was adopted from Harter (1).

C. Results

The immediate effects of the short course are shown in Table 1. There was a statistically significant difference between the number of "true" and "?" answers before and after the course, and from this we gather that there

TABLE 1
The Effects of a Short Course in Independent Thinking on 25 Expressions of Superstition, Prejudice and Misconception

	Statements	Answers before course True	False	?	Answers after course True	False	?
1	Trade does not contribute to production	9	14	4	5	7	15
2	Cunning women cure many people, who are given up by medical science	16	9	2	10	9	8
3.	An uncertain glance betrays a bad character	6	16	5	3	18	6
4	It is bad luck to start anything on Monday	1	26	0	0	25	2
5	Present day youth is more intelligent and industrious than the youth of former ages	18	5	4	6	9	12
6	The lower classes have on the whole a better character than the more well-to-do	10	10	7	6	11	10
7	Certain amulettes and mascots protect you against accidents	1	23	3	1	23	3
8	The Danish soldier has always shown himself more brave and enduring than his opponent	10	10	7	3	14	10
9.	Some numbers are lucky others unlucky	4	20	3	0	23	4
10	Knowledge of good and evil is inborn	6	16	5	10	11	6
11	The Church always serves capitalism	9	13	5	7	9	11
12	The spiritualists can communicate with the spirits of the dead	5	20	2	2	20	5

on account of lacking evidence This was in accordance with the tendency of the lectures.

Yet it must be recognized that some of the "true" and "false" answers made at the second presentation of the questionnaire may be the outcome of a process of estimating the degree of probability of the statements. Some of the subjects may have thought that overwhelming evidence pointed to the falseness of a statement such as "An uncertain glance betrays a bad character" or to the truth of some of the other statements. So the questionnaire does not measure the full extent of the analyzing process.

It was possible to make some observations on the students' ways of reasoning and discussing during the remaining part of the term (three months), and to draw some conclusions from those observations No doubt the effect was greatest in the more intelligent subjects They had comparatively fewer "true" answers and their ways of arguing and discussing changed perceptibly. The least intelligent, however, did not profit much from the course

Further, after three months the effects were still perceptible in three or perhaps four of the students, while it was impossible to say whether the course had lasting effects upon the other subjects. But we may safely conclude that for the majority such a course would have little or no lasting effects

We still do not know to what extent people of average intelligence and average educational standard can learn to think independently, but when a few actually do learn something from such a short course, it is highly probable that much better results could be obtained from longer and more thorough courses More individual teaching of the principles of independent thinking might yield good results, too This seems to be the line of action to take. An even more simplified account of the theory of logical positivism would not do justice to the theory, and it would certainly not be able to stimulate and educate the subjects to independent thinking to the same extent as the already abridged representation

E SUMMARY

A short course consisting of three lectures on the main principles of logical positivism and the imperfection of the human senses proved to have a significant immediate effect on superstitions, prejudices, and misconceptions held by 27 Danish unemployed attending a college course

A lasting effect was only shown in a few cases, and the evidence points to a longer and more thorough course if more than a few are to profit from such an immunization against prejudice and subversive propaganda.

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SHORT ARTICLES AND NOTES

Journal of Genetic Psychology, 1948, 72, 303-305.

ERRORS WHICH CAN AND SHOULD BE AVOIDED IN SCORING THE STANFORD-BINET SCALE*

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There are a number of errors in scoring the Stanford-Binet scale which occur rather frequently, apparently as a result of the attitude of different examiners toward their work and toward their patients, and having to do with work habits developed by an examiner as he accumulates his testing experience in the field While preparing a paper for publication some months ago (1) which involved an exhaustive analysis of 88 Stanford-Binet tests (Terman-Merrill revision) administered to 39 nursery school children (74 Form *L* and 14 Form *M*) by three examiners, certain tendencies of different examiners to use the test material somewhat differently became evident All three of the examiners in question were well trained, experienced clinical psychologists, and this author feels that if they and others like them show test use variations as shown in this set of records, those less experienced and less conscientious would show even more tendency to error, thus the importance of pointing out common recording and scoring errors in an effort to avoid them.

Frequently an examiner forgets that his records will not be as readable to other examiners later as they are to himself. He fails to fill in minus or plus signs on each test item When analyzed later, it is impossible to tell whether the items were actually given or whether the score was estimated from the items actually marked.

Some examiners credit refusals and others do not They seem to make personal judgments on the spot, that is, some feel that the child can do it but will not, so they credit the refusal as a passed item in computing the final score. Others feel the child can't do items he refuses, so they score refusals as failures. Others mark failures on what sometimes were refusals, thus misjudging the child's emotional approach to the item.

Some examiners allow themselves to be influenced by the halo effect, they

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over-estimate intelligence on tests which they feel are inconclusive A case in point is that of a child who obtained an *IQ* of 105 when first tested. The examiner reported that the child "probably is of superior intelligence" Retest later showed only average intelligence, however, so the examiner's personal impression of the child's actual mental ability was not as accurate as the Stanford-Binet score on the first test given

Examiners at times "under-test," i e., they don't give the time and effort necessary to get the maximum score, once the retest score equals that of tests previously given

Some apparently stop testing when the child has failed five of six items at one level, assuming (probably to save time) that the next level is the final level without actually giving the six or eight items involved

There is evidence, too, that some examiners omit the administration of types of items which they find troublesome or time-consuming to give For example, one examiner consistently omitted giving Objects from Memory at *Year IV and Three Commissions at IV-6. This showed up on all tests out* of the 88 studied for this analysis which were given by that particular examiner What he did was to credit the alternate test shown on the test blank at those levels This looks like an effort to save time, as the alternates are items given at the previous level which can be credited at the next level if passed with enough credits. As the mental functions measured by the alternates are different from those measured by Objects from Memory and Three Commissions, it is not easy to see how the test results reported by this examiner could be as valid as if this time-saving practice were not indulged

When the test records of only three examiners show the scoring variations indicated above, one only can guess how many errors of this type appear due to the personal working habits of hundreds of workers in the field Add to this the scoring errors of inexperienced and poorly trained workers, including those physicians, psychiatrists, social workers, teachers, and others who after giving a few intelligence tests in a superficial manner, feel that they can score them and get a "pretty good idea" of their patients' intelligence, and *there is cause for wonder that this test instrument and others give as much* real help in the clinical field as they actually do

No one claims mathematical accuracy in measuring the total mental capacity of a human being, but the Stanford-Binet scale has proven itself to be the most widely useful and accurate measure of the intelligence of children that we have at our disposal Therefore, it is urged that workers in the field discipline themselves to give and score tests as accurately and completely as they can, thus realizing the full clinical value of the Stanford-Binet scale

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Journal of Genetic Psychology, 1948, 72, 307-311

THE RELIABILITY OF PERSONALITY TRAITS DIFFERENTIATING DELINQUENT AND NON-DELINQUENT GIRLS*

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An earlier study by one of the present writers (1) described a method by which traits were selected which distinguish delinquent from non-delinquent boys. These traits were found to be statistically reliable in differentiating the two groups (2). A later investigation by one of the present writers and Feitman (3) dealt with the problem of traits which differentiate delinquent from non-delinquent girls. The present study is concerned with testing the reliability of the traits which emerged from comparisons of delinquent with non-delinquent girls.

The basic instrument from which differentiating characteristics were selected was the Interest-Attitude Tests, devised by Pressey (6). The technique consists of four sub-tests, each containing 90 items. Each array of 90 items falls under a different category, i.e., four different arrays of traits: (*a*) things considered wrong, (*b*) anxieties, fears, worries, (*c*) likes and interests, and (*d*) kinds of people liked or admired. Following are the traits from each category which were found to distinguish delinquent and non-delinquent girls:

Test I (Things considered wrong) accidents (+), speeding (+), arguing (+), being shabby (+), punishment (+) carrying a revolver (+)

Table II (Anxieties, fears, worries): poison (+), choking (+), knives (+), crimes (+), family (+), jail (+), disease (+), sickness (+), operation (+), wrecks (+)

Test III (Likes and interests) clothes (+), bicycling (+), roller skating (+), cooking (+), children (+), tap dancing (+)

Test IV (Kinds of people liked or admired) lovely (+), husky (+), wealthy (+), well-dressed (+), joyful (+), kind (+), handsome (+)

As will be noted, there are 29 traits or qualities out of a total of 360 in the four sub-tests of the Interest-Attitude Tests which differentiate delinquent from non-delinquent girls All of the differentiating items are given plus designations, denoting that delinquents responded with greater frequency to them than non-delinquents

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For purposes of determining the reliability of the unit of differential items, a method of scoring similar in all respects to one employed in former studies (2, 4, 5) was used *The method is as follows* · The subject is *instructed* to single-cross (X) or double-cross (XX) items in each of the four sub-tests. Intensity of response is revealed through single or double crossings No limitation is placed on the number of items in each array of 90 to which responses may be made The number of items which elicit responses may be few or many. Likewise the subject is free to single or double-cross items according to personal predilection. To obtain a differential score on the Interest-Attitude Tests only the 29 items listed previously were used, irrespective of the total number of responses made by each subject Following is an example of differential scoring

> Case *L*, a 16 year-old delinquent girl On Test I responses were as follows to the differential items XX speeding, XX arguing, XX being shabby, XX carrying a revolver No responses were made on the items accidents and punishment Summing the items, double crossed items counting two, single-crossed one, a score of 8 is obtained. On Test II responses are: X poison, X choking, XX family, X disease, XX wrecks no responses were made to the items knives, crimes, jail, sickness, or operation The score on Test II is 7 Test III responses are XX children, XX tap dancing, XX bicycling, XX roller skating, XX cooking, XX clothes Responses were made to all differential items on Test III, the score being 12. Test IV responses are XX lovely, XX well-dressed, XX joyful, XX kind, X handsome No responses were made to the items husky and wealthy. The score on Test IV is 9. The differential score for the entire instrument was obtained by adding the differential scores for each sub-test, which in the illustrative case is 8, 7, 12, and 9, or 36

The highest possible differential score obtainable is 58, the sum of all double-crossed items, the lowest possible score 0 Therefore, differential scores varied between these two extremes

For purposes of determining the reliability of the differentiating traits, the present investigators administered the Interest-Attitude Tests to additional control and experimental groups. The experimental group was constituted of 276 delinquent girls from five different institutions. Life ages ranged from 13 years to 17 years, 11 months All delinquent subjects were of the white race The control group consisted of 151 non-delinquent girls, all of the white race, and covering the same age range as the experimental group The tests from these two groups were differentially scored according to the procedure described heretofore and a series of comparisons drawn. Statistical treatment of the data occurring from the differential scores of the experimental and control groups assumed three forms: (*a*) graphic presentation of the comparative distributions of differential scores, (*b*) analysis of the overlapping of the two groups, and (*c*) determination of the reliability of differences in terms of $\frac{D}{PE_{(diff)}}$.

Figure 1 shows comparative distributions of differential scores. It is clear that the distribution of scores for non-delinquent girls is positively skewed, while the distribution for delinquent girls approximates a normal frequency surface.

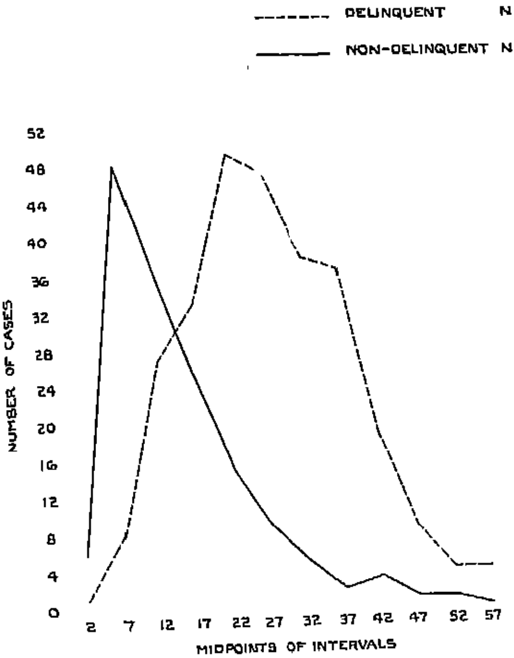

FIGURE 1
COMPARATIVE DISTRIBUTIONS OF DIFFERENTIAL SCORES

Considering the comparative groups from the standpoint of overlap, it was found that on the average age-for-age slightly more than 85 per cent of non-delinquents scored below the median differential score for delinquents. For the experimental and control groups as a whole the respective median differential scores were 26.6 and 12.5. Approximately 89 per cent of the control group scored below the median differential score of the experimental group.

As has been indicated, reliability of differences between mean differential scores was tested by the conventional statistical formula $\frac{D}{PE_{(diff)}}$ in which a value of 4 or greater is indicative of significant difference. Table 1 shows the pertinent information emerging from this phase of the analysis From this table it is evident that differences are reliable at all ages and for the total of each of the comparative groups.

TABLE 1
COMPARISON OF DELINQUENT AND NON-DELINQUENT GIRLS IN DIFFERENTIAL SCORES ON THE INTEREST-ATTITUDE TESTS

Group	No. of cases	Mean	Diff of means	PE_{diff}	$\frac{D}{PE_{(diff)}}$
13-yr delinquent	16	28.3	10.0	1.7	5.9
13-yr non delinquent	19	18.3			
14-yr delinquent	56	28.3	11.7	1.6	7.3
14-yr non-delinquent	39	16.6			
15-yr delinquent	54	25.3	11.0	1.6	6.9
15-yr non-delinquent	28	14.3			
16-yr delinquent	78	28.0	15.0	1.3	11.5
16-yr non-delinquent	34	13.0			
17-yr delinquent	72	27.0	14.2	1.1	12.9
17-yr non-delinquent	31	12.8			
Mixed Ages, delinquent	276	27.3	12.7	.7	18.1
Mixed Ages, non-delinquent	151	14.6			

A few conclusions and suggestions may be drawn from this study The *delinquent girl expresses her personality in terms of a pattern of characteristics* which differentiates her reliably from the adjusted girl In relation to certain things that the delinquent girl considers wrong, things about which she worries or is anxious, things which are of interest, or qualities she admires in others, she presents a different picture than the non-delinquent girl. The comparative groups are not mutually exclusive. Some overlapping in differential scores is in evidence. On the whole, however, it may be assumed that no more than 10 to 15 per cent of non-delinquent girls exceed the median differential score for delinquent girls.

Elsewhere (2) it has been suggested that differential items found for boys might have significant use in screening from an unselected population those boys who though not delinquent may have potentialities for becoming so Since the present study shows that the pattern of traits for delinquent girls is reliable, it appears that the same practical application is possible in the case of an unselected population of girls as has been suggested for boys Screening of the kind described would lay the foundation for effective mental hygiene at a critical point.

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Journal of Genetic Psychology, 1948, 72, 313-330

BOOKS

The *Journal of Genetic Psychology*, the *Journal of General Psychology*, and the *Journal of Social Psychology*, will buy competent reviews at not less than $2 per printed page and not more than $3 per printed page, but not more than $15.00 for a single review.

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CRITICAL REVIEWS OF RECENT BOOKS

Journal of Genetic Psychology, 1948, 72, 315-319

(Burt, Sir Cyril Intelligence and Fertility The Effect of the Differential Birth Rate on Inborn Mental Characteristics. London Hamilton 1946)

REVIEWED BY RAYMOND B CATTELL

This survey was prepared at the request of the Royal Commission on Population, which, it is refreshing to realize, is probably the first of government population inquiries to concern itself with the quality as well as the quantity of population The slimness of the monograph—it can be read in a couple of hours—should not deceive anyone into imagining its contents to be of slender scientific importance or technical interest.

The study begins with an historical review of attempts to answer the question of whether modern societies are suffering from a decline of average inborn mental capacity as a result of the differential birth-rate. As R A Fisher has well reminded sociologists, human communities are unusual, in that evolution, or, to be precise, the differential survival rate, depends more on the differential birth rate than the differential death rate The magnitude of the differentials, for various social and occupational groups, can be seen from the most cursory glance at social statistics to be capable of producing unprecedentedly rapid historical changes. For the past 20 years the bulk of responsible opinion among social psychologists has been that the change, as far as intelligence is concerned, is in a downward direction It is amazing that a question of such immense practical import has been neglected by social psychologists—save for the work of Burt, Cattell, and Fraser-Roberts in Britain, and Miles and Lentz in America—and sociologists, who seem to have preferred to weave their theories around travellers' tales from cultural anthropology instead of about this vital psycho-dynamic process measurable in their very midst

Sir Cyril wastes little time over the indirect calculation, e.g, from such data as that of Heron on the differential birth rate in relation to social status in combination with the evidence on intelligence in relation to social status, for he realizes that the only water-tight argument is that founded on direct measures of the relation of intelligence to fertility In view of the many other instances in which Burt has anticipated later research developments it is not surprising to find that in collaboration with Moore he conducted the first (apparently unpublished) investigation directly relating measured intelligence to size of family; *but the first research on an adequate sample* of several thousand families, using non-verbal tests seems to have been that of Cattell, closely followed by Fraser-Roberts. These two studies, on three different areas of Britain and using different tests, arrived, as Burt points out, at remarkably convergent figures

To these findings the writer now adds his own results from the accumulated data during his 20 years as psychologist to the London County Council. *This data is imperfect only in that it* omits the really well-to-do or aristocratic minority, which, according to Public School surveys, is unique in reproducing itself adequately

*Again the results are strongly corroborative, the correlation between intel*ligence and fertility in the different studies varying around —0.2, and the decline per generation inferred from these results being from 1 3 to 2 5 points of *IQ* The writer then checks this main estimate by auxiliary calculations, made with faultless statistical workmanship, from data on (*a*) changes in 20 years in the incidence of mental defect, (*b*) the incidence of scholarship children, and (*c*) through indirect calculations involving the *mean intelligence and mean fertility of districts,* as in Maller's study in the U S. A

In the last resort, however, social psychologists will require the check of actual testings on populations for which declines have been predicted Conditions in the Leicester, Devonshire, and Bath areas are excellent for such an experimental check in that the original samples were precisely defined, the identical tests are still available, and the migration in and out is slight. Sociologists and sociological funds, however, seem to have been otherwise engaged Fortunately Burt is able, nevertheless, to give psychologists at length some definite evidence on actual test-re-test differences, though the *London areas for which he obtains it are subject to migration, of known* direction but of not too well known amount Between 1913 and 1939 the decline found by Burt averages 0 87 points of *IQ,* but allowing for various influences and samples it is concluded to be somewhat larger

Indeed the final summing up is that: "The indirect (fertility calculation) method suggests a decline of about 1 9 points, possibly more (per generation), the direct method suggests a decline of 1 5 points at the outside, probably much less." Incidentally Burt correctly recognizes that the larger decline (2.5) points) found in Cattell's survey is due to using a non-verbal test with a larger *SD* (24 points) which when reduced to the *SD* of the Binet is closely similar to that of the other two surveys He does not, however, notice that the apparently non-conforming correlation by the same experiments for intelligence against economic status (page 14) is due to grouping and can also be readily reconciled with others Burt also performs the calculation of partialling out social status to show that an inverse relation of intelligence and fertility holds within a single class This agrees with Cattell's direct data showing that within single occupations the more intelligent, by tests, belong to more restricted families

Assuming that Burt's data on the direct measurement of intelligence change in the London school population is sound, we are faced by the mystery of the discrepancy between this measurement and that inferred from differential fertility Parenthetically one may add that the mystery is still bigger to those optimistic souls who, claiming that they see no evidence anywhere in the modern world of declining intelligence, refuse to believe that the calculation from differential fertility can have any validity at all! A difference of calculated and discovered decline amounting to 0 4 points of *IQ* per generation is admittedly small, but it is undoubtedly in the direction of the inferred decline being an overestimate, and one wonders where the overestimate can have occurred. In the first place one can argue that the error is really in the direct measurement. Burt remarks that significant differences of *IQ* exist between rural and urban areas, and between different urban areas and concludes "the most readily established changes in *IQ* seem traceable to migration rather than to alterations in the native endowment of stationary population " Migration certainly affected Burt's results Secondly, the improved teaching methods for the sub-average and backward may have raised the test scores of the total population slightly, in so far as the Binet tests are contaminated with verbal or other skills.

While the errors in the direct measurement of intelligence level are likely to reduce the apparent decline, the effects of the errors in the calculation from differential fertility cannot be so readily agreed upon Describing six little known or controlled factors in that calculation (39th Yearbook of the National Society for the Study of Education, Part I) the present writer has suggested that the only one likely to upset the calculation at all seriously is the unknown relative intelligence of unmarried adults. For if those who marry are more intelligent it would be possible for a dysgenic birth rate to exist among them without the level of the community as a whole falling from generation to generation. A point of possible criticism of Burt's thesis is that he unhesitatingly assumes that "unmarried and childless adults . . include a disproportionate number of persons whose intelligence is above the average "

I know of no evidence of this, and feel that experimental data on this missing link in the argument is long overdue.

A second omission from the argument is any discussion of the relative *survival rate* of persons above and below average intelligence. It is not so difficult to extract evidence on this matter from existing social psychological surveys of one kind or another, and there is little doubt that the survival to later age groups, notably to the reproductive age, would, even today, be found decidedly higher in the more intelligent. While cynic and sentimentalist may find room for argument as to whether the more intelligent better survive the danger of marriage, there is little doubt that they survive better the other hazards of life, and it is possible that this is the principal reason for the calculated decline on differential birth rate presenting a slightly worse picture than the actually found decline.

As to the social dynamics, causes and consequences, of the decline, Burt does not risk a guess. Perhaps in so brief a work, and for the specific purposes of the Royal Commission, such speculation would have been out of place. But to social psychologists who have had little doubt, for the past 10 years, about the reality of the trend itself, the centre of interest has naturally shifted to causes. As pointed out in the *39th Yearbook of the National Society for the Study of Education,* restriction of birth rate correlates most not with absolute social status but with striving for upward mobility. It is the act of the intelligent (but not too intelligent!) when placed in a strong field of social competition. Burt's observation, "In America, the inverse correlation between fertility and intelligence would seem to be, if anything, larger than in this country," is, if true, an additional argument for the "competition" theory of restriction.

Burt does, however, venture certain further interesting observations that show he recognizes the dysgenic trend as no mere static, self-contained mechanical process but part of a changing, organic reaction involving the whole cultural pattern. First he makes one of those non-experimental but shrewd observations to which his position as a life long worker in the practical social psychology of educational measurement gives weight, that "During the last 30 years, the correlation between economic status and children's intelligence has, if anything, slightly increased. It would seem that the effect of educational and vocational guidance has been rather to enhance the tendency to class-segregation according to intelligence." This would certainly be expected, especially in a country like Britain in which scholarships, with maintenance, to higher education are so plentiful, for most social promotion takes place "between generations," in the schools. Along with assortative mating this is likely to increase the dispersion of intelligence and make still less true any literal interpretation of the statement that "all men are created equal."

The second of Burt's implicit interpretations of the overall cultural causes and consequences is contained in the statement, "With the rise in standard of living and pleasure throughout the whole community, the class correlation (of fertility) will, I feel sure, grow smaller, and the partial correlation with intelligence will soon outweigh the partial correlation with economic group." The spread of birth control facilities, through clinics, to the ignorant and poor will doubtless be a factor in this change, but the main advance is to be expected from a spread of competition, i.e., of possibilities of ego-involved material standards, to that group which was previously too poor to have the possibility of entering competition This apparently leaves the correlation of fertility and intelligence untouched, but in fact, by one of those organic connections which remains to be properly investigated it seems likely that reduction of birth rate at the lower part of the social scale will be accompanied by reversal of the intelligence-fertility relation elsewhere

Intentionally Sir Cyril Burt's treatment does not launch out on these more speculative matters, and indeed it is true that at the present moment it would be more valuable, scientifically, to obtain a definite answer to the two questions which he asks himself, namely (*a*) how big is the dysgenic trend as correctly calculated from differential fertility, and (*b*) does the result check with direct measurements of communities over an interval of years? His review of the researches in the first field, carried out with that resource, objectivity, and flexible handling of statistics that one has learnt to expect from him, gives a very convincing answer, despite the one unknown quantity—the unmarried. His answer to the second is less convincing because it is based on less clear data. It is scandalous that a matter of such great social importance should go uninvestigated for lack of the few thousand dollars necessary to repeat the testing in the areas already surveyed 10 or more years ago. However, the discrepancy in the two values is in the direction one would expect from the differential survival rates, and the final conclusion, as presented by Sir Cyril Burt so lucidly to the Population Commission, is one which responsible workers in the field are bound to endorse. It will be interesting to see if there are enough statesmen among the politicians to ensure that appropriate social remedies will be undertaken.

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(Wolff, W. The Personality of the Preschool Child. New York: Grune & Stratton, 1946. Pp. 341.)

Reviewed by Dorothy Tilden Spoerl

Although one of the most stimulating books in its field the reviewer has come across in recent years, *The Personality of the Preschool Child* by Werner Wolff of Bard College is hampered to a large degree by a number of serious defects. The total feeling that one gains while reading the book is one of extreme lack of organization. Many of the chapters read as though they were notes jotted down at one time or another, later to be organized into a coherent whole. But one feels that they were published as notes without that organization. A disproportionate amount of the illustrative material, observational notes, is diffuse and the author has not clarified the relationship it bears to the particular point under consideration.

At the same time the book is a veritable treasure chest of ideas, a sentence here, an illustration there, a partially developed experiment somewhere else that starts the mind off on a long series of associated thoughts leading to many ideas for further investigation. Disappointing yet rewarding, enlightening and yet superficial, above all experimentally suggestive but at the same time experimentally inadequate, the book is nevertheless well worth the time it takes to sift through the material in a thoughtful way and with an appraising attitude.

Part 1 is entitled *Observation* and contains chapters on the mind of the child, the emotions of the child, his social life, and his concept of reality. Here in particular appears that feeling of "notes taken in the process of observation," until one wonders if Part 1 is called *Observation* for that reason.

The most valuable feature of this part is the provocative distinctions which are made between the world and environment of the adult and that of the child. Constantly Dr. Wolff warns against any tendency to observe the behavior of children and then interpret that behavior in terms of what it would have meant had it been adult behavior. His lucid clarification of some of the reasons for the specialized meanings that must be given to child behavior is a valuable contribution to our thinking.

Distinguishing between the mind of the child and that of the adult Dr. Wolff points out that there are both quantitative and qualitative features that make differentiation of the two minds possible. The child's experiences are extremely limited, and unchecked for validity. His perspective is different because (due to his size) he sees a different portion and view of the world Above all his ego is not crystalized, and therefore the child externalizes things. Various special problems as they relate to the child are discussed, the most valuable being his discussion of the confusions in the child's environmental situation. There is for him a confusion of words, since so often they sound the same but have different meanings He confuses relationships, learning that every "voice is a sound, but not every sound is a voice" The greatest confusion the author feels is that between reality and imagination And the particular significance of these confusions lies in their relationship to the process of learning in the child, making it, too, different from learning in the adult

Again in the second chapter he compares the emotions of the child with those of the adult The differences stemming from the fact that the child has not as yet an organized self The total emphasis which Dr. Wolff puts on this matter of the organization of the self is stressed in the subtitle of the book, "The Child's Search for His Self" To the reviewer the most provocative section of this chapter is that which deals with the structure of the child's aggression. Aggression in the adult he maintains is the "direction of the energies of the adult's self against non-selves," while the "child attacking another person is not interested in the reaction of that person, but in the experience of his own explosion" Much of child behavior, even at the preschool level, seems too directly related to the non-self present in the environment for this position to be easily accepted by those with nursery school experience, and yet one thinks of many instances where such an explanation adds considerable depth to one's interpretation of certain observed behavior He does not assemble much evidence to back up this position, yet it does suggest a number of experimental approaches that might prove to contain results of considerable interest Among the various types of aggression, for the most part illustrated by anecdotal observation rather than discussed, are sadism and masochism in children, verbal aggression, aggression realized in imagination, in action, as a function of psychic tension and as compensation However, the chapter is suggestive rather than convincing and none of the ideas are set forth with clarity or with any depth in the observations or the discussions. The material for a searching discussion is present, but the discussion is not there

The third chapter, on social life, contains nothing particularly new or stimulating The chief theme, observationally illustrated, is that the differences in perceiving society and expressing social relationships are what differentiate the child from the adult And as before he maintains that the child's self not yet being crystallized is the cause of the difference

Obviously the child's concept of reality would be different from that of the adult In this fourth chapter Wolff takes issue with Piaget at several points, *although to the present reviewer it is not* quite clear how he differs from Piaget when the material has been set forth An illustration does not make a difference, only a pertinent discussion of that illustration can clarify dividing issues if they be present. Reality, Wolff maintains, is difficult for the child because he has no constancy of position, no conception of past and future, no established relations, and other similar factors. In the various problems, such as birth, death, dreams, and all it is the child's search for his self which prompts his wonderings, and it is this search that is really paramount in the child's attempts to understand reality.

Part 3 (we are saving Part 2 for later discussion as it seems the most important of the book) deals according to its title with· *Theory* It includes only three chapters, one concerned with the principles of children's art, one with the educational bridge between the world of the child and the world of the adult, and the last with methods in child psychology. To call so narrow a selection of materials "theory" seems highly questionable, for theory should be more inclusive and give an underlying point of view which, as a frame of reference, would tie together the various materials of the book. This the author has clearly failed to do. Indeed at points in the discussion one wonders how familiar Dr. Wolff is with some of the present day materials on child psychology, this in spite of a bibliography of 628 items included at the back of the book. For a present day child psychologist to present as "misconceptions about child personality," such things as, "the child as a dwarf," "the child as a marionette," "the child as a savage," and the "child as an idol," is to misconstrue both the professional material of the present day and even what could possibly be described as the average parental attitude. There are a number of conclusions drawn here and there in Part 3, but the fundamental material from which they are drawn (if there was any) does not seem to be present there or elsewhere in the book Part 3 is by far the weakest section of the whole presentation.

Let us then turn our attention to the section on *Experimentation,* Part 2, at once the most stimulating and the most infuriating part of the book. One must register the protest that although it is extremely interesting material, the author has published much of it long before it was ready to be presented as a body of scientific fact *It is, indeed, like Part 1 material which* gives the impression of being a running comment on material which one planned later to organize into a system of thought that would be logical and conclusive

Some 12 or so of the experiments which mention the number of children used illustrate the superficial quality of the conclusions which might be drawn. A matching experiment for showing the degree of personality present in drawing with three subjects, *one experiment with seven, two with ten,* three with 15, and one with 20 children. In several instances the course of development is in one or two or three children. While these numbers are sufficient for preliminary investigation it is certainly not sufficient for establishing new methods or for drawing scientific conclusions, and in one instance at least the work is referred to as "preliminary" but that which was beyond the preliminary does not appear. Certainly none of this is adequate for any new idea that might prove to have the far reaching consequences which his "Rhythmic Quotient" would have were it to be validated.

And once more in this section one is struck with the feeling that Dr. Wolff is perhaps not as familiar as he should be with the vast amount of bibliographical work presented, for some of his work has been done more thoroughly by others with highly similar results. He has listed over a hundred references at the end of the chapter in Part 3 on *Principles of Children's Art,* 26 of these under the headings of "development of personality in drawings," and "diagnosis of personality in drawings," yet we find him making the statement that, "the general opinion of child psychologists has been that the preschool child's drawing is determined either by chance or by imitation, and not by the child's personality." Many studies of preschool children's art, some of them listed by Dr. Wolff, have clearly shown the influence of personality on drawing, and certainly one can say quite dogmatically that no such opinion as has been quoted above is the "general opinion of child psychologists." Most definitely not in the last decade, and for many not true much earlier than that.

Three of the experiments struck the present reviewer as having particular potential value. They are experiments that one would like to see repeated on larger populations, and carried out to their logical conclusions. One of these is the ingenious test devised by Dr. Wolff, called a "Security Test." Three units are used, the "High-Low Unit," where the child can draw a figure high or low on a ladder, on a swing, or jumping from a height. One, "Protection Alone Unit" where there is a picture of a table with a child who can jump either to his mother standing at one side, or jump the other direction to run into a garden. In this unit there is another with two squares, one containing a schematic figure, the other blank, and the child is told that a child is crying and asked which room he will run to, the one where mother is or the empty one. The same method is used again when a child is supposed to be dressing and can go to either room. In the last, "Gay-

Serious" unit there is a schematic face with concave and convex mouths that can be placed in position. The child is asked which mouth the face should have in a full face, a profile, and a figure lying or sitting in bed.

The various reactions given to the test show that it has great potential value, and might well be standardized, especially unit one, for useful interpretation of children. But one would want to know how much the insecure child would answer in terms of his real self, or his desired self. One would like to know how much the repressed child would answer in terms of what he wants to do, or what his mother would permit him to do. Yet for this very reason the test has values which no actual situation could present (as for instance giving a real ladder to the child and asking him to climb it) because it is possible that it might provide a means for getting material on the level of aspiration of the preschool child without the necessity for that verbalization which is so difficult for him. Wolff himself admits that more material is necessary before one can evaluate the individual case through the test, and one wonders why he presented it in this very inconclusive state?

Dr Wolff's work on expressive behavior in preschool children, previously presented in an article in *Character and Personality* (1942), is probably already familiar to most child psychologists. The reviewer has found this material, with the help that comes from projection of the accompanying illustrations onto a screen, extremely stimulating to students who are sometimes slow to accept the implications or even the facts of the consistency of expressive movement at any age level. Only three children are considered, but the consistency of their expressive movement in very varied situations is striking. In these situations, such as way of standing, approaching a balloon, using a jar of cold cream, finger painting, etc., the differing expressions of their inner structure are very clear. Wolff is concerned with such questions as the interrelationship of graphic movements, the structure of forms and lines, the texture of strokes, the direction of strokes, and other similar movements. He suggests methods for grapho-analysis taking into account these various suggested factors. For instance, under expression of graphic movements certain plus factors are strong pressure, determination, continuity, curves, width, sufficiency, shape, while minus indicators are weak pressure, irresolution, interruption, angles, narrowness, insufficiency and shapelessness. All of these are incisive suggestions which stimulate thought, and yet because of the inadequacy of the experimental basis one does not feel that as yet valid conclusions can be drawn from them.

Probably the most highly original idea in the book is Dr Wolff's idea of what he calls the "Rhythmic Quotient." He feels that this has a relation to intelligence, and yet again one wonders what Wolff can have been reading that causes him to make the statement, "Intelligence, which largely depends on factors of learning and training, seems to be paralleled by innate potentialities." What is the "Rhythmic Quotient"? By measuring various details of any given picture, such as vertical and horizontal length of different parts of the figure, or distances between "significant portions" of the drawing, or distances from the main features to the limits of the main parts, one can determine the proportions. On page 176 he states,

> The rhythmic quotient would appear in the relationship of proportions to given elements. Thus we divide the achievement, i.e., the number of proportions, *P*, by the given elements in the drawing, *E*. The division *P/E* in which we omit the decimal point, gives the *RQ*, the rhythmic quotient.

perhaps clarification will come from one of the briefer analysis of a drawing given on page 181.

> The drawing has 15 elements: head, two eyes, two eyebrows, two ears, nose, mouth, belly, three buttons on the belly, two legs. The following proportions appear:
>
> 1. The middle button is the center of the belly.
> 2. Both legs are of equal length.
> 3. The distance between the middle and upper button equals the distance between the middle and lower button.
> 4. The extension of the eyebrows equals the extension of the eyes.
>
> *RQ* = *P/E* = 4/15 = 26.6 (medium)

It is Dr. Wolff's thesis that if the degree of *IQ* is similar to that of *RQ* there would be an indication of a unified pattern of personality. Any discrepancy between the two would have to be explained in terms of the dynamics of personality. If a sufficient body of material were collected in regard to the *RQ* so that it could be applied to material with as much certainty as the *IQ* (which is, after all, not asking for very much certainty!) psychology would have a powerful tool for judging those cases where there was a lack of proportion between the individual and many factors in his environment. It might be a means of making many valuable conclusions in regard to various factors present when psychometric examination is in progress. But it certainly is none of these things in the present state of the research.

In the one instance where the developmental consistency of the *RQ* is studied he has used the drawings presented in Eng's *The Psychology of Children's Drawings*. Studying this developmental sequence of drawings

Wolff has found consistent expression of *RQ*, even in the two strokes made the first time the child in question held a pencil, where the short stroke was exactly half the length of the long one Also presented are analysis of some drawings made by African children, some extremely interesting material showing consistency and change of rhythm in pictures secured from seven children before and after epileptic seizure, and also some graphic expressions of the blind.

In these three experiments, as well as in some of the others that have not been cited, there is much which when validated will be of real value in the field of child psychology. One cannot help but wish that as creative a mind as Dr. Wolff's had gone a little deeper into one or two problems rather than spreading itself thinly over many But in spite of the defects of the book it is of real value for the psychologist who would like to be stimulated by novel approaches to some of the older problems, to the research worker who is interested in the possibilities of new methods, or to any psychologically minded reader who likes to have his thinking jolted on occasion. The reading of Dr. Wolff's book was to the reviewer at least an engrossing and interesting experience, and one to be recommended

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